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*On the Physical Geography of the Himálaya. By B. H. HODGSON, Esq.*

A clear outline, illustrated by a sketch map, of the principal natural divisions of the Himálaya, is, and long has been, a great desideratum; for, physical Geography, which derives so many aids from the other physical sciences, is expected in return to render back to them without unnecessary delay a distinct demarcation of its own provinces, since by that alone researchers in so many departments are enabled to refer the respective phænomena they are versant with to their appropriate local habitations, in a manner that shall be readily intelligible, causally significant, and wholly independant of the shifting and unmeaning arrondissementments of politics.

It is true that our knowledge of the large portion of these mountains lying beyond the limits of British dominion, is far from complete. But is our knowledge any thing like complete of our own hill possessions? and, if we are to wait until Népal, Sikim and Bhútán become thoroughly carossable to science, must we not indefinitely postpone a work, the most material part of which may (I think) be performed with such information as we now possess?

The details of Geography, ordinarily so called, are wearisomely insignificant; but the grand features of physical geography have a pregnant value, as being alike suggestive of new knowledge, and facilitative of the orderly distribution and ready retention of old. I purpose to adhere to those grand features, and to exhibit them in that causal connexion which gives them their high interest with men of mind.

I had been for several years a traveller in the Himálaya before I could get rid of that tyranny of the senses which so strongly impresses almost all beholders of this stupendous scenery with the conviction that the mighty maze is quite without a plan. My first step towards freedom from this overpowering obtrusiveness of impressions of sense was obtained by steady attention to the fact that the vast volume of the Himálayan waters, flows more or less at right angles to the general direction of the Himálaya, but so that the numberless streams of the mountains are directed into a few grand rivers of the plains, either at or near the confines of the two regions. My next step was due to the singular significance of the topographic nomenclature of the Nepalese, whose "Sapt Gandaki" and "Sapt Cousika,"\* rivetted my attention upon the peculiar aqueous system of the Himálayas, urging me thence forward to discover, if possible, what cause operated this marked convergence of innumerable transverse parallel streams, so as to bring them into a limited series of distinct main rivers. My third and last step was achieved when I discovered that the transcendant elevation and forward position, at right angles to the line of gháts, of the great snowy peaks, presented that causal agency I was in search of, the remotest radiating points of the feeders of each great river being coincident with the successive loftiest masses† belonging to the entire extent of the Himálaya. It was in Népal that this solution of these problems occurred to me, and so uniformly did the numerous routes I possessed represent the points of extreme divergence of the great rivers by their feeders as syntopical with the highest peaks, that I should probably long ago have satisfied myself upon the subject, if my then correspondent, Capt. Herbert, had not so decidedly insisted on the very opposite doctrine—to wit, that the great peaks intersect instead of bounding the principal alpine river basins.

Capt. Herbert's extensive personal conversancy with the western Himálaya, added to his high professional attainments, made me for a long time diffident of my own views. But, the progress of events and increasing knowledge of other parts of the chain, seeming to confirm

\* See Journal, No. 198 for Dec. 1848, p. 646, &c.

† This expression is used advisedly, for every pre-eminent elevation of the Himálaya is not so much a peak as a cluster of peaks springing from a huge sustaining and connected base.



Name of the Peaks	Heights	Latitudes	Longitudes	Remarks
a. Ananda-Devi	25658 <sup>b</sup>	30 55 0	78 12 0	J. & S. A. 126
A. Ananda-Devi	25403	30 11 21	79 57 24	G.T.S. A. N. 1
B. Dhaulagiri	27600	29 10 0	85 0 0	J. & S. Vol. 1; J. & S. ut supra
c. Annapurna	24300	28 10 0	86 0 0	J. & S. Vol. 1; J. & S.
D. Dhaulagiri	28170	27 41 35	85 11 40	G.T.S.
E. Annapurna	25979	27 42 0	89 18 0	J. & S. Vol. 1; 48
F. Annapurna	21600 21376 <sup>a</sup>	27 50 0	92 50 0	Timberlin's Report and Map

REMARK a. Seems the West and A the East limit of the Alpine basin of the Orange  
 A. D<sup>a</sup> East limit of the alpine Ganges-China F the West of the Alpine Himalayan Basin  
 B. D<sup>b</sup> D<sup>b</sup> D<sup>b</sup> Ananda-Devi F D<sup>b</sup> D<sup>b</sup> basin of the Ganges  
 C. D<sup>c</sup> D<sup>c</sup> D<sup>c</sup> Gandakian D<sup>c</sup> D<sup>c</sup> D<sup>c</sup> Indian basin  
 D. D<sup>d</sup> D<sup>d</sup> D<sup>d</sup> Ananda-Devi D<sup>d</sup> D<sup>d</sup> D<sup>d</sup> Tibetan basin  
 E. D<sup>e</sup> D<sup>e</sup> D<sup>e</sup> Dhaulagiri D<sup>e</sup> D<sup>e</sup> D<sup>e</sup> basin of the Ananda-Devi  
 F. D<sup>f</sup> D<sup>f</sup> D<sup>f</sup> of last named basin or that of the Ananda-Devi West of the basin of the sub-Himalayas

NATURAL DIVISIONS OF THE HIMALAYAN MOUNTAINS



the accuracy of those views, it occurred to me more carefully to investigate whether the facts and the reason of the case were not, upon the whole, demonstrative of the inaccuracy of that able and lamented officer's dogma. Doubtless the western Himálaya presents appearances calculated to sustain Capt. Herbert's opinion, whilst such persons only as are unaccustomed to deal with the classifications of science will expect them to correspond point by point with those natural phænomena, which it is at least one chief merit of such arrangements, merely to enable us readily to grasp and retain. But, that the entire body of facts now within our ken is upon the whole opposed to Capt. H.'s doctrine,\* and that that doctrine suits ill with the recognised axioms of geology and geography, is, I think, certain, and I shall with diffidence now proceed to attempt the proof of it.

A tyro in geology, I shall not further dwell on the theoretical side of the question than may be requisite to facilitate and complete the apprehension of my readers: but the facts, quoad Nepal at least, I trust that my sketch map, rude as it is, and the following observations, may render sufficiently indisputable; it being always remembered that I deal with generals, not particulars, aiming to establish the general accuracy of my main proposition, viz., that the great peaks, bound instead of intersecting the alpine river basins, and that, in truth, the peaks by so bounding *create* the basins, whereas their *intersection would destroy them*.

And now, without further preface, I turn to the accompanying sketch map, and submit such remarks as it seems to require. It will be seen at a glance that it embraces the whole Himálaya from 78° to 94° of longitude, comprising the following peaks and basins;—peak of Jamnoutri (a), peak of Nanda-dévi (A), peak of Dhoula-giri (B), peak of Gosainthán (C), peak of Kāngchang (D), peak of Chumalari (E), peak of the Gemini† (e): which peaks include and constitute the following alpine river basins, viz., that of the Ganges, that of the Karnáli, that of the Gandak, that of the Cósi, that of the Tishta, that of the Mónas, and that of the Subhansri (pars). The subjoined table exhibits the elevation and the position of these dominant peaks with the authority for both.

\* Journal, No. 126, Extra, pp. 20 and 22.

† I have so named the two proximate peaks of nearly equal height, which are inserted without name in Pemberton's large map, in long. 92° 50', lat. 27° 50'.

a	Jamnoutri	25669	30°55'	78°12'	J. A. S. No. 126, As. Res. Vol. XII.
A	Nanda-dévi	25598	30°22'	79°50'	J. A. S. No. 126.
B	Dhoula-giri	27600	29°10'	83°	As. Res. Vol. XII. J. A. S. No. 126.
C	Gosain-than	24700	28°20'	86°	As. Res. Vol. XII.
D	Kangchang	28176	27°42'	88°10'	J. A. S. No. 197, with map annexed.
E	Chumalari	23929	27°52'	89°18'	The same.
e	Gemini	{ 21600 21476 }	27°50'	92°50'	Pemberton's Report and map.

The longitudinal dark lines of the map indicate, the upper one, the Himálaya proper, the lower one, the last low range verging on the plains. The transverse or vertical dark lines denote the great peaks with the ridges sent southwards by them. The Himálaya proper is traced along the line of the gháts or water shed between Tibet and India; and the principal passes of Népal and Sikim into Tibet, or Taklakhár, Mústáng, Kérúng, Kúti, Hatia, Wallúng, Láchén, are set down along the Himálaya, as well for their novelty as to illustrate the ghát line of the snows.

Along the last low range of hills are marked the position of the Máris or Dhúns, within the range, and the position of the Bháver and Tarai, without it.

Sallyán mári, Gongtali mári, Chitwan mári, Makwáni mári and Bijay-púr mári, are so many Nepalese samples of those singular quasi valleys, termed Dhúns to the westward.\* In the plateau of Tibet I have indicated the limits of the three great trans-Himálayan provinces, or Gnári, extending (from the Bélúr) easterly to the Gangri boundary range of lake Mépang; Útsáng, thence stretching to the Gakbo river beyond Lassa; and Khám, which reaches from the Gakbo river to the Yúnling or Péling or limitary range of China and Tibet. Thus, reverting to the regions south of the line of gháts leading into Tibet, we have, clearly defined, the several natural provinces or divisions of the Himálaya, with their causal distribution, as follows, commencing from the westward, 1st, the alpine basin of the Ganges, extended from the peak of Jamnoutri to the peak of Nanda-dévi (Juwár or Juwáhir,) or, in other words, from east long. 78° 12' to 79° 50': 2nd, the alpine basin of the Karnáli, reaching from the peak of Nanda-dévi to that of Dhoula-giri, or from 79° 50' to 83°: 3rd, the alpine basin of the Gandak, stretching from the peak of Dhoula-giri to that of Gosain-than, or

\* See J. A. S. No. 126, p. xxxiii. et seq. and p. cxxxiv.



from  $83^{\circ}$  to  $86^{\circ}$  : 4th, the alpine basin of the Cósi extending from the peak of Gosain-thán to that of Kangchang, or from  $86^{\circ}$  to  $88^{\circ} 10'$  : 5th, the alpine basin of the Tishta, reaching from the peak of Kangchang to that of Chumalári, or from  $88^{\circ} 10'$  to  $89^{\circ} 18'$  : 6th, the alpine basin of the Mónás, stretching from the peak of Chumalári to that of the Gemini, or from  $89^{\circ} 18'$  to  $92^{\circ} 50'$  : and, lastly, the alpine basin of the Subhansri, of which the western limit is the Gemini, but the eastern peak, unascertained. It should be sought somewhat about  $94^{\circ} 50'$  between which point and the extreme eastern limits of the Himálaya, must be the basin of the Dihóng. That the above distribution of the Himálaya into natural districts is, upon the whole, as consistent with the facts as it is eminently commodious and highly suggestive, I have no hesitation of asserting. Lest however I should extend my present<sup>t</sup> Essay to undue limits to trench upon the province of Col. Waugh and the other able professional men who are now engaged upon the western hills, I shall say nothing further of the alpine valley of the Ganges and those west of it, nor upon those lying east of Sikim. If my main assumption be valid, it will be easily worked out by abler hands and better furnished ones than mine : wherefore the following more detailed expositions will be chiefly confined to the three great central basins of the Karnáli, the Gandak, and the Cósi. In the first of these basins we have (successively from west to east) the Sarjú, the Góri, the Káli, the Swéti-ganga, the Karnáli proper, the Bhéri and the Jhingrak or Rapti. And it is certain that, whereas these streams drain the whole alpine valley of the Karnáli, so their most westerly source and course is confined on the west by the Nanda-devi peak, as their most easterly is limited on the east by that of Dhoulá-giri. These rivers do not wholly unite within the hills, though their tendency to union is so decided that they are known by one name, even in the plains, where their collective appellation is Sarjú, vel Káli, vel Ghógra. In the hills the whole of them are universally denominated by the collective name of Karnáli (corrupted by Rennell and his followers into Kenár). Karnáli is the proper name of this noble river, the Karnáli branch being by far the largest the central and most remote of origin. It rises in Tibet, not far from one of the sources of the Satlege, and has a considerable trans-Himálayan course to the westward of the Taklakhár pass, where it quits Tibet. No natural district can be more distinct than the alpine basin of

the Karnáli, as above defined. It includes the political divisions of Káli Kúmáun, belonging to Britain, and of the Báisi, or 22 Rájes of Nepál, with Yúmila vel Júmla, Dóti and Sallyán. In the second basin, or that of the Gandak, we have, successively from the west, as before, the Barigár, the Náráyani, the Swéti-gandaki, the Marsyángdi, the Daramdi, the Gandi, and the Trisúl. These are the "Sapt Gandaki" or seven Gandaks of the Nepalese, and they unite on the plainward verge of the mountains at Tirbéni above Sáran. They drain the whole hills between Dhoula-giri and Gosain-thán; the Barigár and one head of the Náráyani, rising from the former barrier, and the Trisúl, with every drop of water supplied by its affluents, from the latter. Nor does a single streamlet of the Trisúl arise east of the peak of Gosain-thán, nor one dribble of the Barigár deduce itself from the westward of Dhoula-giri. We have thus in the alpine basin of the Gandak another admirably defined natural division comprised within two great proximate Hímálayan peaks. This division is named, vernacularly, the Sapt Gandaki. It includes the old Choubísi, or 24 Rájes and belongs to the modern kingdom of Népál.

Our third sample of a Hímálayan natural province conterminous with the utmost spread of the feeders of a large river, and bounded on either hand by a prime snowy peak, is the basin of the Cósi, which, like the Gandak, has seven principal feeders. These are as follows: the Milamchi, the Bhotia Cósi, the Támba Cósi, the Likhú, the Dúd Cósi, the Arún, and the Tamór. Of these, the Milamchi, rising from Gosain-thán, is the most westerly, and the Tamór, rising from Kangchang, is the most easterly, feeder.\* And those two great peaks, with the pre-eminent ridges they send forth southwards, include every drop of water that reaches the great Cósi of the plains through its seven alpine branches. All these branches, as in the case of the Gandak, unite (at Varáha Kshétra above Náthpúr) within the hills, so that the unity of this alpine basin also is as clear as are its limitary peaks and its extent.

The alpine basin of the Cósi is denominated by the Nepalese the Sapt Cousika, or country of the seven Cósis. It comprises the old Rájes of the Kirántis,† Limbús and Kála Makwánis, and is included, like the two prior basins, in the modern kingdom of Népál.

\* See J. A. S. No. 189. Route from Kathmandu to Darjeeling.

† The classical Cirrhatæ, and a once dominant and powerful race, though they

The country drained by the above three rivers (Karnáli, Gandak and Cósi) includes the whole of Népál and the proximate part of Kúmáun, or, in other words, 800 miles of the central and most characteristic portion of the Himálaya. Wherefore it is legitimately presumeable that whatever is true of its natural divisions, is true of those of the residue, quoad ruling principle and geological causation.

Now, if the above facts relative to these three rivers be justly represented (and that they are so, in the main, I confidently assert), we are led irresistibly to inquire *why* the numerous large feeders of the rivers, instead of urging their impetuous way from the snows to the plains by independant courses, are brought together upon or near the verge of the plains? *how* unity is effected among them despite the interminable maze of ridges they traverse, and despite the straight downward impulse given them at their sources?—I answer, it is because of the superior elevation of the lateral barriers of these river basins, between which there are synclinal slopes of such decided preponderance that they overrule the effect of all other inequalities of surface, how vast soever the latter may sometimes be.

It will be seen by the map that these lateral barriers of the river basins are crowned by the pre-eminent Himálayan peaks, that the peaks themselves have a forward position in respect to the ghát line or great longitudinal water shed between Tibet and India, and that from these stupendous peaks, ridges are sent forth southwards proportionably immense. Thus from the peak of Kangchang is sent forth the ridge of Singiléla, which towers as loftily over all the other sub-Himálayan ridges of eastern Népál and western Sikim as does Kangchang itself over all the other Himálayan peaks.

This Singilélan prolongation (so to speak) of Kangchang, entirely separates the waters of the Cósi and of the Tishta. A similar ridge, that of Dayabhang,\* stretching south from the great peak of Gosainthán, as entirely divorces the waters of the Cósi and of the Gandak. Another like ridge rising from Dhoula-giri as effectually sunders the waters of the Gandak and of the Karnáli. Another starting from

have long since succumbed to the political supremacy of other races—first the Makwánis and then the Gorkhális.

\* Hence the name Dhaibúng, erroneously applied by Col. Crawford to the peak. Dayabhang, the destroyer of pity, from the severity of the ascent.

Nunda-dévi in like manner wholly separates the proximate feeders of the Karnáli and of the Ganges; whilst yet another originating with Jamnoutri, wholly separates the Ganges from the Jumna.

Equally effective with the divergent power of each of these supremely peaked ridges, which run parallel to each other and at right angles to the ghát line of the snowy range, upon two river basins, as just noticed, is of course the convergent power of two ridges upon the single contained river basin. The synclinal lines from the inner faces of the two adjacent ridges draw the waters together; and, because these ridged peaks are the *loftiest masses of the entire mountains*, the effect of all their other masses, even that of the spine of Hemáchal or the ghát line of the snows, is overruled or modified, so that in the ruggedest region on earth a very limited series of distinct main rivers appears in the plains from innumerable independent alpine feeders, in the manner which all behold but few indeed think of referring to its cause.

It is inconsistent with all we know of the action of those hypogene forces which raise mountains, to suppose that the points of greatest intensity in the pristine action of such forces, as marked by the loftiest peaks, should not be surrounded by a proportionate circumjacent intumescence of the general mass; and, if there be such an intumescence of the general surface around each pre-eminent Himálayan peak, it will follow, as clearly in logical sequence as in plain fact it is apparent, that these grand peak crowned ridges will determine the essential character of the aqueous distribution of the very extended mountainous chain (1800 miles) along which they occur at certain palpable and tolerably regular intervals. Now, that the infinite volume of the Himálayan waters is, in fact, pretty regularly distributed into a small number of large rivers, we all see; and, whereas the fact is thoroughly explicable upon my assumption that the great peaks bound, instead of intersecting, the river basins, it is wholly inexplicable upon Capt. Herbert's assumption that the said peaks intersect the basins.

The above are normal samples of Himálayan water distribution, and it is very observable that whereas all those principal streams which exhibit the unitizing principle so decidedly, take their origin in the alpine region, at or near the snows, so the inferior streams which rise from the middle region only, show no such tendency to union, but pursue their solitary routes to the Ganges; as for example, the Mahanada, the Méchi, the

Konki the Bágmati, the Gumti, the Cosilla and the Rámghanga. Here is both positive and negative evidence in favour of the doctrine, I advocate as furnishing the key to the aqueous system and natural divisions of the Himálaya ; for, the upper rivers do, and the lower rivers do not, stand exposed to the influence of the great peaks.

The petty streams of the lower region or that next the plains, which water the Dhúns vel Maris, traverse those valleys lengthwise ; and, as the valleys themselves run usually parallel to the ghát line of the snows, such is also the direction of these petty streams. In the central, as in the western,\* hills they usually disembody into the rivers of the first class.

I have observed that the three great river basins of the Karnáli, Gandak and Cósi extend throughout Nepál ; and truly so ; for a river basin, includes the widest space drained by its feeders. But, it results necessarily from the manner in which the deltic basins of the Himálayan rivers are formed, that there should be intervals between the plainward apices of these deltic basins. Of these intervals the most conspicuous in Népal, is that which intervenes between the Cósi and Gandak. This tract, watered by the Bágmati, deserves separate mention on many accounts, and it may be conveniently styled the valley region, since it contains not only the great valley of Népal proper, but also the subordinate vales of Chitlong, Banépa and Panouti.

It has been already remarked that the classifications of physical geography, as of the other sciences, do not constitute a perfect "open sesame" to the mysteries of nature, but only a material help to their study. This observation I will illustrate by a few comments on the basin of the Tishta, lest the somewhat anomalous instance of that basin, should be captiously quoted to impugn the doctrine I contend for ; but contend for, not as exhibiting in every instance an absolute conformity with natural arrangements, but as doing all that can be reasonably expected in that way, and as furnishing, upon the whole, a generally truthful, causally significant, and practically useful, indication of those arrangements.

I have stated above that the basin of the Tishta extends from the peak of Kangchang to that of Chúmalári. But an inspection of the accompanying map will show that between these two peaks there occurs

\* J. A. S. No. 126, p. xxxiii.

what miners call "a fault" in the ghát line of the snows, which line, after proceeding N. Easterly from the Láchén to Powhanry,\* dips suddenly to the south for nearly 40 miles, and then returns to Chúmalári. A triangular space called Chúmbi is thus detached from the Himálaya and attached to Tibet; and the basin of the Thista is thus narrowed on the east by this salient angle of the snows, which cuts off the Chúmbi district from the Tishtan basin, instead of allowing that basin to stretch easterly to the base of Chúmalári. Chúmbi is drained by the Máchú of Campbell, which is doubtfully referred to the Torsha of the plains, but which may possibly be identical with the Háchú of Turner and Griffiths,† or the Gaddada of the plains. But besides that these points are still unsettled, it will be noted that one of the transnivean feeders of the Tishta rounds Powhanry and rises from a lake (Cholámú) approximating to Chúmalári; so, that, one way or another, the Tishta may be said, without much violence, to spread its basin from Kangchang to Chúmalári.

Chúmbi and all the adjacent parts of the plateau of Tibet, constitute a region as singular as is the access to it from Sikim by the Láchén pass. That pass surmounted, you at once find yourself, without descent, upon an open undulated swardy tract, through which the eastern transnivean feeders of the Tishta and of the Arún sluggishly and tortuously creep, as though loath to pass the Himálaya, towards which

\* Vide Waugh's outline of the snowy range of Sikim, J. A. S. loc. cit.

† Embassy to Tibet and J. A. S. Nos. 87 and 88, with sketch maps annexed. Also Pemberton's large map of the eastern frontier. Rennell is not easily reconcilable with them. In the accompanying map I had identified the lakes of Cholámú, which give rise to the Tishta, with Turner's lakes. But I now learn from Hooker that the latter lie a good deal east of the former, and I am satisfied that Campbell's Máchú is distinct from Turner's Hachu. We need, and shall thus find, space in the hills correspondent to that in the plains watered by Rennell's Torsha and Saradingoh and Gaddada and Suncósi. The Máchú, (Maha tchieu apud Turner) rises from the West flank of Chúmalári. The Háchú of Turner is a feeder joining his Máchú from the West. The Chaa chù of Turner is the Suncósi of Rangpúr: his Tehin chù is the Gaddada, and his Máhá chù, the Torsha. The Arún has its rise in the broken country of Tibet lying N. and a little W. of the sources of the Tishta and South of the Kamhalá, or great range forming the Southern boundary of the valley of the Yáru. This broken country Dr. Hooker estimates at from 16 to 18000 feet above the sea. It is a good deal terraced near Himachal.

indeed it is not easy to perceive how they are impelled, the plateau of Tibet sloping on their right to Digarchi, and seeming to invite the streams that way. There is however of course a water-shed, though by no means a palpable one; and we know by the signal instances of the vast rivers of South America and those of north-eastern Europe, how inconspicuous sometimes are the most important water-sheds of the globe. The sources and courses of the feeders of the Tishta will shortly be fully illustrated by Dr. Hooker, my enterprising and accomplished guest, to whom I am indebted for the above information relative to the Láchén pass and its vicinity, and whose promised map of Sikim, which state is the political equivalent for the basin of the Tishta, will leave nothing to be desired further on that head.

But the Himálaya must necessarily be contemplated in its breadth as well as its length; and we have therefore still to consider what regional divisions belong to these mountains in relation to their breadth, or the distance between the ghát line of the snows and the plains of India.

The Himálayan mountains extend from the great bend of the Indus, to the great bend of the Brahmapútra, or from Gilgit to Brahma Kúnd, between which their length is 1800 miles. Their mean breadth is about 90 miles; the maximum, about 110, and the minimum, 70 miles. The mean breadth of 90 miles may be most conveniently divided into three equal portions, each of which will therefore have 30 miles of extent. These transverse climatic divisions must be, of course, more or less arbitrary, and a microscopic vision would be disposed to increase them considerably beyond three, with reference to geological, to botanical, or to zoological, phænomena. But, upon comparing Capt. Herbert's distribution of geological phænomena with my own of zoological, and Dr. Hooker's of botanical, I am satisfied that three are enough. These regions I have already\* denominated the lower, the middle and the upper. They extend from the external margin of the Tarai to the ghát line of the snows. The lower region may be conveniently divided into—I. the sand-stone range with its contained Dhúns or Máris;—II. the Bháver or Saul forest;—III. the Tarai. The other two regions require no subdivisions. The following appear to be those demarcations by height which most fitly indicate the three regions.

\* J. A. S. for December 1847, and June 1848.

<i>Name.</i>	<i>Elevational limits.</i>
Lower region . . . . .	Level of the plains to 4000 feet above the sea.
Central region . . . . .	4000 to 10,000 feet above the sea.
Upper region . . . . .	10,000 to 16,000* feet above the sea : Highest peak measured is 28,176.

It is needless to remind those who are conversant with physical geography, that in passing in a tropical country, by a long and gradual ascent, from near the sea level to several (4-6) miles above it, one must necessarily meet with regions equivalent, quoad organic phænomena to the three great zones of the earth, or the tropical, the temperate and the arctic; and, in fact, our three regions above indicated correspond in the main with those zones, and might be named after them, but that it is desirable to avoid terms involving theory, when those designating mere facts will suffice. Nor is it merely by organic phænomena that the three regions are contradistinguished.

In geology the upper region is the locale of granites and gneisses; the middle region, that of gneisses and schists; the lower region that of the sandstone formation and of diluvial debris. It may be added that granite is much more extensively developed, in the upper region than had been supposed, and that igneous rocks are by no means so entirely unknown. Indeed igneous *action* is displayed to a stupendous degree, in the hypogene rocks both stratified and unstratified of the upper and even central region. In botany the first is the region of Junipers, Cedars, Larches, dwarf Rhododendrons, Hollies, Willows, Walnuts, Birches, and in general of the superior sorts of Coniferæ; the second, that of Oaks, Chesnuts, Magnolias, Laurels, Alders, tree Rhododendrons (many kinds). Cherry and Pear trees (large and wild), Oleas (large forest tree), Maples, Wax trees, Camelias, tree ferns, some few and peculiar Palms (Chamerops, &c.), and the inferior sorts of Pines; the last, that of Sauls (*Shorea*), *Sissus* (*Dalbergia*), Acacias, Tunds (*Cedrela*), cotton trees (*Bombax*), tree figs, (*Catechu*, *Iudicus et Religiosus*.) *Buteas*, *Dillenias*, *Baudangas*, *Erythrinas*, *Premnas*, some common Palms (*Phœnix*, &c.) but rare and poor, and, lastly, tree ferns, but much rarer than above. *Pinus longifolia* likewise recurs in this region, but not one other of the many

\* This is about the average height of the gháts and of the perpetual snow. It is also nearly the limit of possible investigation, and of the existence of organic phænomena. But the upward limit need not be rigorously assigned.



Conifers above.\* In Zoology, again, to begin with man, the upper region is the exclusive habit of the Bhótias, who extend along the whole line of the gháts, and who, with the name, have retained the lingual and physical characteristics of their tramontane brethren. To the central region are confined, but each in their own province from east to west, the Mishmis, the Bors and Abors, the Ákás, the Daphlas, the Lhópás, the Lepchas, the Limbús, the Kirántis, the Múrmis, the Néwárs, the Súnwárs, the Chépángs, the Gúrúngs, the Magars, the Khas or Khasias, the Kóhlis, the Garhwális, the Kakkas, the Bambas, the Gakars, the Khatirs, the Awáns, and the Janjúhs. To the lower region are as exclusively limited the Kócch, the Bódó, the Dhimál, the Kíchak, the Thárú, the Dénwár, the Pallah, and the Bóksar. Of these races, those of the central region are all of transnivean origin like the first named; but they are much altered in speech and aspect, by 12 to 15 centuries of residence in a csnivean climate, and by mixture in some few cases (as Khas or Khasia) with southern blood; whilst the races of the lower region are of the aboriginal Indian or Tamulian stock, and nearly unmixed, though some of them have adopted the speech and customs of the Hindus.† The hill Bráhmans, Rájputés and Moslems so common to the westward, so rare to the eastward, are mere modern immigrants from the plains. It is very deserving of special notice that the people of the upper region cannot endure the climate of the central one, nor those of the central region, the climate of the lower one; so that the distribution even of the human race in the Himálaya affords a remarkable verification of our triple transverse division from a quarter the least likely to afford any such argument. But to proceed to our zoological enumerations. To the upper region exclusively belong, among the Ruminants, the Bisons (*Poepagus*) and Musks, the wild goats (*Ibex*, *Hemitragus*) and wild sheep (*Pseudois*,

\* Last winter Dr. Hooker pointed out to me in the lower region a Hawthorn and a Horse Chesnut. But these are exceptional traits.

† For these tribes see J. A. S. for December 1847, and April and June 1848, and May 1849; also the prior paper in the same by Mr. Brown. Essay on the Kocch, Bodo, and Dhimal Languages and Literature of Nepal. Cunningham's History of the Sikhs, and Hamilton's Nepal. The Kholis of Kumaon are one of the tribes of Helot craftsmen of India, who are most of them Tamulian in origin, I think; but the subject is yet to be treated.

Ovis) among the Rodents, the Marmots and Pikas (*Lagomys*); among Plantigrades, the Bears proper (*Ursus*). In the middle region, true Bovines (*Bos*) take the place of the Bisons of the upper region; Caprine Antelopes (*Nemorhædus*, *Kemas*) replace its Musks and wild goats and sheep; common Rats, and Mice, and Hares, and Porcupines, and Hedgehogs, its Marmots and Pikas; and sun Bears (*Helarctos*) its true Bears; whilst the Deer family, unknown to the upper region, is here represented only\* by the anomalous stilt-horns (*Stylocerus*). In the lower region the ox family is represented by *Bibos* and *Bubalus*; (splendid wild types); the deer family, here abundant, by *Rusas*, Stags, Axes, and stilt-horns to boot; the Antelopes by *Tetracerus*, or the four-horned kiud; the Rodents by the *Bambú* rats (*Rizomys*) and spiny hares (*Caprolagus*); and the bear family by the honey bears (*Melursus*); add to all which that to this region are exclusively confined all the large *Pachydermes*, such as the Elephant and *Rhinoceros*; and the Monkeys also (*Semnopithecus* et *Macacus*) though not so exclusively in their case. The carnivora, again, are represented in the upper region by ounces, by foxes of a large sort (*Montanus*), by the weasels proper, and by the *Ailuri* or Cat lories; in the middle region by the wild Dogs (*Cyon*), the Marten weasels, leopards, thick-tailed leopards (*Macroceloides*), wild cats (*Murmensis*, *Pardochrous*, *Ogilbii*), Lybian lynxes (*Lybicus*). Zibets, Screwtails (*Paradoxurus*), and *Prionodons*; and in the lower region by tigers, leopards, hyenas, wolves, jackals, † insectivorous foxes (*Kokri*), Bear badgers (*Ursitaxus*), *Urvas*, *Mangooses*, *Helictes* or Oriental gluttons, small civets (*Viverrula*), *Hirsute* screwtails, and shapfaced cats (*celidogaster*). Zibets recur in this region but rarely, and one small species of *Mongoose* is found in special spots of the central region. The otters in the upper region are represented by the small golden and brown species (*Aurobruunea*); in the central, by *monticola* and *indigitata*; in the lower, by the large

\* I am fully aware that *Rusas* (*Sámber*) are found in the western hills, but a careful consideration of the facts in that part of the Himálaya with due advertence to the known habits of the group, satisfies me that these deer have been driven into the western hills by the clearance of the *Tarai* and *Bháver*.

† Jackals have made their way (like crows) to the most populous spots of the central region, but they are not proper to the region, nor Indian foxes, though some of the latter turned out by me in 1827 in the great valley of Nepal, have multiplied and settled their race there. *Ex his disce alia*.

Chinese species (*Sinensis*). Among the squirrels, the great thick-tailed and purple species (*Macruroïdes* et *Purpureus*) belong solely to the lower region; the small Lokries (*Locria* et *Locroïdes*) to the central; and the Siberian, to the upper; whilst flying squirrels, a numerous group, are confined to the central region, so far as appears. In the Bat group, the frugivorous species, or Pteropines, all are limited to the lower region, whilst the horse shoes (*Rhinolophinæ*) specially affect the central region; and the bats proper (*Vespertilioninæ*) seem to be the sole representatives of the family in the northern region. From the class of birds we may select as characteristic of the three regions the following:—

The true pheasants (*Phasianus*), the Tetrugalli, the sanguine pheasants (*Ithaginis*), the horned and the crested pheasants (*Cerionis*, *Lophophorus*) of the upper region, are replaced by fowl pheasants (*Gallophasis*)\* in the mid-region, and by fowls proper (*Gallus*) in the lower. In like manner, among the partridges (*Perdicinæ*), the grouse partridges (*Tetrauperdix*) belong exclusively to the upper region; the chakórs (*Caccabis*) and the tree partridges (*Arboricola*) to the central; and the Francolines (*Francolinus*) to the lower, though the black species of this last form are also found in the mid-region. In the pigeon group the blanched pigeons (*Leuconta*) belong solely to the upper region; the vinous pigeons (*Hodgsoni*) to the central, and the green, the golden, and the banded (*Treron*, *Chalcophaps*, *Macropygia*) as entirely to the lower; the *Trerons* alone partially entering the central tract from the lower.

The splendid Edolian shrikes (*Chibia*, *Chaptia*, *Edolius*) belong exclusively to the lower region. They are replaced in the central tract by plain *Dicrurines*, and in the upper, by plainer *Lanians*. The cotton birds (*Campephaga*) of the south are replaced by gaudy *Ampelines* (*Cochoa*) and *Leiothricinians* (*Leiothrix*, *Pteruthius*, *Cutia*) in the middle region: but both groups seem excluded from the north. Among

\* The influence of longitude on geographic distribution might be singularly illustrated, did space permit, from numerous Himálayan groups, Galline and other: thus, for example, a black-breasted *Cerionis* is never seen east of the Káli, nor a red-breasted one west of it. So of the black and white crested *Gallophases*; whilst a black-backed one is never seen west of the Arún, nor a white back, east of it.

the Fly-catchers the gaudy or remarkable species and forms, belong wholly or chiefly to the lower region, as Tchitrea, Rhipidura, Cryptolopha, Myiagra, Hemichelidon, Chelidorynx; whilst those which approach the warblers (Niltava, Siphia, Digenea) belong to the mid-region; and the plainer and more European types are alone found in the northern.

Among the Fissirostres, Goat-suckers and Swallows are pretty generally distributed; but Rollers, Bee-eaters, Eurylaimi, Trogons and all such gaudy types belong to the south, with only occasional alpine representatives, as Bucia is of Merops. The tenuirostral birds belong distinctively to the lower region. Yet they have representatives or summer visitants in all three, even among the Sun-birds. Upon the whole however it may be safely said that the Sun-birds (Nectarinia) belong to the south; the Honey-suckers (Meliphagidæ) to the centre and south; and the Creepers, Nut-hatches and Wrens\* to the north and centre. The Sylvians or warblers are too ubiquitous, or too migratory for our present purpose, even Boreal types being common in the lower region in the cold weather. Horn-bills, Barbets, Parroquets (Palæornis, Psittacula) belong to the lower region, though they have a few representatives in the central; none in the upper. Wood-peckers abound in the lower and central regions, but are rare in the upper. True Cuckoos (Cuculus) are as common and numerous in the central region as walking Cuckoos (Phænicophaus, Centropus), &c. are in the southern, where also the golden (Chrysococcyx) and dicurine Cuckoos (Pseudornis) have their sole abode, whilst what few of the group belong to the upper region, are all allied to the European type. The Ravens, Pies, Choughs, Nut-crackers and Conostomes of the upper region are replaced in the central region by Tree Pies (Cissa, Dendrocitta), Jays, Rocket birds (Psilorhinus), Pie thrushes (Garrulax), Timalias, and Hoopoe thrushes (Pomatorhinus); and in the lower region by the common Indian crows (Culminatus et Splendens), Grackles, † stares, vagabond pies

\* I have in this paper followed without entirely approving Mr. Gray junior's classification of my collections in the printed catalogue. The geographic distribution is now attempted for the first time. But I will recur to the subject in a separate paper devoted to it.

† When Darjiling was established there was not a crow or pastor to be seen. Now there are a few crows but no pastors. Enormously abundant as both are in

and dirt birds (*Malococercus*). Thrushes proper with rock thrushes, Ousels, Myophones, Zootheres, Tesias and Hypispetes are as abundant in the central and upper region as Bulbuls, Orioles, Pittas, are in the central and lower.

In the Finch family the Haw-finches, Bull-finches, Gold-finches and Cross-bills (*Loxia*) are as strictly confined to the upper region, as are the corvine *Conostomes*, Nut-crackers, Choughs and Ravens. The former are replaced in the central region by the Buntings, Wood-finches (*Montifringilla*), and Siskins; and in the lower region, by the Weavers and *Múnias*. The Raptorial birds are, in general, too cosmopolitan to subserve the purposes of Geographic distribution. Still it may be remarked that the true eagles belong, quoad breeding at least, to the upper region; the crested eagles (*Circæetus*), the Neopuses and Hawk eagles (*Spizaetus*) to the central; and the Pernes (*Haliaetus et Pandion*) and *Haliasturs* to the lower. Among the vultures the distinction is more marked: for, the eagle vultures (*Gypaetus*) belong exclusively to the upper region; the large European vultures (*Fulvus et Cinereus*) to the central; and the Neophrons, and the small Indian vultures (*Bengalensis et Tenuirostris*) to the lower. The Himálaya abounds in Falconidæ, all the occidental types and species being found there and many more, peculiar and oriental ones; and it deserves special remark that whereas the former (*Imperialis, Chrysætos, Lanarius, Peregrinus, Palumbarius, Nisus, &c.*) affect the upper and central regions, the oriental types (*Hypotriorchis, Haliastar, Jerax, Hyptiopus, Elanus, Poliornis*) are quite confined to the lower region.

Those perfect cosmopolitans the waders and swimmers, migrate regularly in April and October, between the plains of India and Tibet, and, in general, may be said to be wanting in the mountains though most abundant in the Tarai. The great Herons (*Nobilis et Cinereus*) the great Storks (*Nigra et Purpurea*) and great Cranes (the *Cyrus* and *Damoiselle*) of the Tarai are never seen in the mountains where the Egrets alone represent the first group. But the soft-billed smaller waders (*scolopacidæ*) are sufficiently common in the mountains, in which the woodcock abounds, breeding in the upper region and frequenting the central, and rarely the lower, region, from the lower region, this sufficiently proves they are not native to the central tract though common in the great valley of Nepal.

October till April. Geese, ducks and teals swarm in the Tarai, where every occidental type (so to speak, for they are ubiquitous) may be seen from October till April; and many oriental non-migratory types; whereas in the mountains the Mergansers (*orientalis*) and the Corvoraunts (*Sinensis* et *Pygmæns*) only are found, and that very scantily; with a few Rails and Gallinules and Sandpipers, from the vast host of the Waders.\*

But I must hasten from these zoological details to make some remarks on the subdivisions of the lower region, a subject which, though in many ways interesting and important, is so little understood that the celebrated Mrs. Somerville in her very recent treatise of physical geography has represented the Tarai as being *within* not only the Bháver, but the sandstone range.†

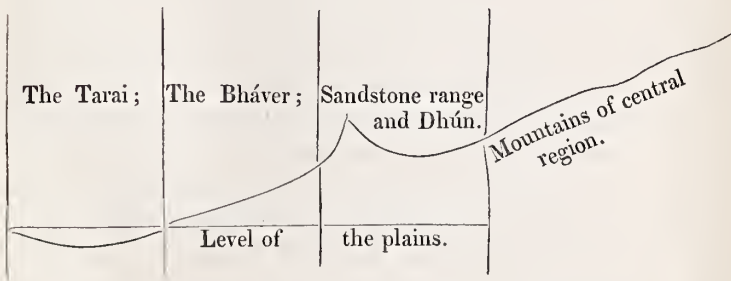
All observant persons who have proceeded from any part of the plains of India into the *Himálaya* are sensible of having passed through an intermediate region distinguished by many peculiarities; and, if their route have lain to the N. W., they can hardly have failed to notice successively the verdant Tarai, so unlike the arid plains of upper India; the vast primæval Saul forest, so every way unique; and the Dhúns or valleys, separated from the last tract by a low range of hills. The natives of the plains have in all ages recognised these several distinct parts of the lower *Himálayan* region which they have ever been, and are still, wont to frequent periodically, as strangers and foreigners, in order to graze innumerable herds of cows and buffaloes in the Tarai, or to procure the indispensable timber and elephants peculiar to the Bháver, or to obtain the much-prized drugs and dyes, horns and hides, (Deer and Rhinoceros), râls and dhúnas (resin of Saul and of Cheer) and timber of the Dhúns. Nor is there a single tribe of Highlanders between the Cósi and the Sutledge which does not discriminate between the Tarai or Tari, the Jhári or Bháver, and the Dhúns or Máris. Capt. Herbert has admirably described‡ the geological peculiarities and external aspect of each of these well known tracts. His details are,

\* For an ample enumeration of the mammals and birds of the *Himálaya*, (150 sp. of the former, and 650 of the latter,) see separate catalogue printed by order of the Trustees of the British Museum in 1845. The distribution is not there given.

† Physical Geography, Vol. I. p. 66.

‡ J. A. S. No. 126, extra pp. 33 and 133, et seq.

indeed, confined to the space between the Káli and the Sutledge; but the general characteristics of these tracts he affirms to be equally applicable to all the country between the Méchi and the Sutledge; and Capt. Parish, whilst confirming Herbert's statements, makes them so likewise as far westward as the Beas.\* What Capt. Herbert states as holding good from his own personal researches in regard to the western Himálaya (Sutledge to Káli), I can confirm from mine in regard to the Nepalese portion (Káli to Mechi), but with this reservation, that no more in the western than in the Nepalese Himálaya does the sandstone range, with its contained Dhúns, prevail throughout or continuously, but only interruptedly or with intervals; and thus the Sallyán-mári, the Gongtali-mári, the Chitwan-mári, the Makwánpúr-mári and the Bijaypúr-mári of Népál (which are mostly separate) represent with perfect general accuracy the Deyra, Kyarda, Pinjor, Pátali and other Dhúns to the westward. The accompanying sectional outline will give a distincter idea than any words could do of the rela-



*Disposition of parts in lower region of Himálaya.*

tions of the several parts of the lower Himálayan region to the plains on the one hand, and to the mountains on the other, according to Capt. Herbert's views. The continuous basal line represents the level of the plains: the dip on the left, the Tarai; the ascending slope in the centre the Saul forest; the dip on the right, the Dhúns or Máris. It is thus seen that the Tarai sinks below the level of the plains; that the forest forms a gradual even ascent above that level; that the Dhúns

\* J. A. S. Nos. 190 and 202, for April 1848, and 1849.

continue the ascent to the base of the true mountains, but troughwise, or with a concave dip; and, lastly, that the Dhúns are contained between the low sandstone range and the base of the true mountains. *The Tarai* is an open waste, incumbered rather than clothed with grasses. It is notorious for a direful malaria, generated (it is said) by its excessive moisture and swamps—attributes derived, 1st, from its low site, 2nd, from its clayey bottom, 3rd, from innumerable rills percolating through the gravel and sand of the Bháver, and finding issue on the upper verge of the Tarai (where the gravelly or sandy debris from the mountains thins out), without power to form onward channels for their waters into the plains. *The forest* is equally malarious with the Tarai, though it be as dry as the Tarai is wet. The dryness of the forest is caused by the very porous nature of that vast mass of diluvial detritus on which it rests, and which is overlaid only by a thin but rich stratum of vegetable mould, every where sustaining a splendid crop of the invaluable timber tree (*Shorea robusta*), whence this tract derives its name. *The sandstone range* is of very inconsiderable height, though rich in fossils. It does not rise more than 3 to 600 feet above its immediate base, and is in some places half buried (so to speak) in the vast mass of debris through which it penetrates.\* *The Dhúns* are as malarious and as dry as the Bháver. They are from 5 to 10 (often less, in one instance more) miles wide, and 20 to 40 long, sloping from either side towards their centre, and traversed lengthwise by a small stream which discharges itself commonly into one of the great alpine rivers; thus the Ráputi of Chitwan-mári falls into the Gandak, and that of Bijaypúr-mári into the Cósi. The direction of the Máris or Dhúns is parallel to the ghát line of the suows, and their substratum is a very deep bed of debris similar to that of the Bháver, but deeper, and similarly covered by a rich but superficial coating of vegetable

\* The low range which separates the Dhúns and Tarai, on the high road to Kathmándú, consists almost wholly of diluvium, rounded pebbles loosely set in ochreous clay, such as forms the great substratum of Dhún and Bháver. The sandstone formation only shows itself where the rain torrents have worn deep gullies, and it there appears as white weeping sand imperfectly indurated into rock. Anthracite, shale, loam, are found in this quarter, but no organic fossils, such as abound to the westward. Herbert assigns the Siwáliks to the new red formation of geologists. But if I understand Lyell rightly, that formation is inimical to fossils. Is there any mistake as to the technical class of rocks?



mould which, if not cultivated, naturally produces a forest of Saul equal to that outside the sandstone range, and then in like manner harbouring elephants, rhinoceroses, wild bulls (Bibos), wild buffaloes, rusas, and other large deer, with creeping things (Pythons) as gigantic as the quadrupeds. The height of the sandstone range Capt. Herbert estimates at 3000 feet above the sea, or 2000 above the plains adjacent; and that of the Dhúns (at least the great one), at 2500 above the sea, and 1500 above the plains. These measurements indicate sufficiently the heights of the lower region, and it is observable that no elevation short of 3 to 4000 feet above the sea suffices to rid the atmosphere of the lower Himálaya from malaria. Thus, the Tarai, the Bháver and the Dhúns are alike and universally cursed by that plague. And this (by the way) is one among several reasons why I have assigned 4000 feet of elevation as the southern limit of the healthful and temperate mid-region; that above it being the arctic or boreal, and that below it, the tropical, region; though it must never be forgotten that more or less of the tropical characters, especially in the suite of the seasons, pervades the whole breadth (and length likewise) of the Himálaya, whatever be the decrement of heat, and also that from the uncommon depth of the glens in which the great rivers especially run, and which in the Central and even Upper region often reduces the height of those glens above the sea below the limit just assigned for salubrity, such glens are in both these regions not unfrequently as malarious as is the whole lower region.

But, the above characteristics of the subdivisions of the lower Himálayan region, how noticeable soever to the west of the Méchi, are by no means so to the east of that river, where a skilled eye alone can painfully detect the traces\* of the sandstone formation (without which there can be, of course, no Dhúns,) and where the Tarai, considered as a trough running parallel to the mountains, forms no marked feature of the country, if indeed in that sense it can be said to exist at all.

\* In my recent expedition in the Tarai east of the Méchi with Dr. Hooker, that accomplished traveller first detected traces of the sandstone formation, with imperfect coal, shale, &c., in a gully below the Pankabári Bungalow, as well as at Lohagarh. The sandstone rock barely peeped out at the bottom of the gully lying in close proximity with the mountains, so that nothing could be more inconspicuous than it was as a feature in the physiognomy of the country.

And as, even to the westward, the sandstone range, with its contained Dhúns, is by no means constant, it may be desirable to attempt to characterise the lower region considered as a whole without reference to local peculiarities or too rigidly defined subdivisious. Now I conceive that the lower region owes its distinctive character as a whole to the vast mass of diluvial detritus which was shot from the mountains upon the plains, like gravel from a cart, at some great geological epoch, and which has been, since its deposit, variously and often abraded both in degree and direction, by oceanic, and, in a far less degree, by ordinary, floods. Where there was, at the epoch in question, no sandstone range to intercept the downward spread of the debris, this debris would necessarily be carried further south, and be of less thickness; where there *was* such a barrier, it would be carried less far southward and be accumulated in greater thickness, especially within the barrier; and, in like manner, where no sandstone range existed, but only spurs, sent forth, like bent arms, upon the plains from the mountains, the embayed detritus would still be deeply piled and lofty within such spurs,\* and thinly and unequally spread without them, by reason of the action of the spurs on the currents. Again, where, as from Gowhattý to Saddyá, there was not room upon the plains for the free spread and deposit of the descending Himálayan detritus owing to large rapid rivers and to other chains, both parallel and proximate to the Himálaya, the phænomena created elsewhere by the more or less unrestricted spread of the Himálayan detritus over the plains, would necessarily be faintly, if at all, traceable. Lastly, if at the time of the descent of the debris, there existed a great dip in the Gaugetic plains from N. W. to S. E., the lithologic character, as well as the distribution, of the debris, would be materially affected thereby; for, the subsiding oceanic current would have a set from the former to the latter quarter, and would continue to lash

\* There is a signal example of this on the road to Darjiling viâ Pankabári where the debris, embayed by a spur, is accumulated to several hundred feet, and where moreover there is outside the spur a conspicuous succession of terraces, all due to oceanic forces, and clearly showing that the subsidence of the sea was by intervals, and not at once. Constant observation has caused the people of the Tarai to distinguish three principal tiers of terraces, from the prevalent growth of trees upon each. The highest, is the Saul level; the middle, the Khair level and the lowest, the Sissú level; Shorea, Acacia and Dalberga being abundantly developed on the three levels as above enumerated.

the gravel into sand, and here to deposit both in a series of terraces, there perhaps utterly to displace both, in the latter quarter long after the former had emerged from the waves. Now, that the Himálaya really was, at one time, in great part submerged; that the vast mass of detritus from the Himálaya at present spread over the plains in its vicinity, was so spread by the ocean when the founts of the deep were broken up; that this huge bed of detritus, every where forthcoming, is now found in unequal proportion and distribution and state of comminution; as, for example, deeper piled within, than without the sandstone range, and the embaying spurs, and also, more gravelly and abundant to the N. W., more sandy and scant to the S. E. ;\* and, lastly, that the Gangetic plain really now has a great oblique dip† from the Sutledge at Rúper to the Brahmapútra at Gwálpára, whereby all the Himálayan feeders of the Ganges are in the plains so much bent over to the eastward—these are presumptions relative to the past as legitimate as the extant facts suggesting them are incontrovertible; and, we have but to observe how, at the grand epoch adverted to, the action of general causes was necessarily modified by the peculiar features of the scene, as above indicated, in order to come at a just conception of the aspect and character of the lower Himálayan region, all along the line of the mountains. Thus the longitudinal trough parallel to the mountains, and exclusively denominated the Tarai by Capt. Herbert, may to the N. W. have been caused by the set of the subsiding oceanic current from N. W. to S. E. ; but, however caused, it exists as a palpable definite feature only beneath Kumáon; is

\* Capt. Herbert has given statements of its depth to the westward, where there is a sandstone range. To the eastward, where is none, I found it, on the right bank of the Tishta, under the mountains, 120 feet, at 15 miles lower down, 60 to 70 feet, at 15 miles still further off the mountains, 40 to 50 feet. There was here no interruption to the free spread of the detritus, and I followed one continuous slope and level—the main high one. The country exhibited, near the rivers especially, two or three other and subordinate levels or terraces, some marking the effect at unusual floods of extant fluvial action, but others unmistakably that of pristine and oceanic forces. I measured heights from the river. I could not test the subsurface depth of the bed. There was every where much more sand than gravel, and boulders were rare.

† Sabarunpúr is 1000 feet above the sea; Múradábád 600; Gorakpúr 400; Rangpúr 200; Gwálpára 112. My authorities are *As. Res.* Vol. XII. *J. A. S.* No. 126. *Royles Him. Bot.*, *Griffith's Journals*, and *J. Prinsep* in *epist.*

faintly traceable beneath Nepal, and is wholly lost beneath Sikim and Bhútán. But, the great bed of debris is *every where* present, and with no other distinctions than those pointed out, whether it be divided into Bháver and Dhún, by the sandstone range, as is usually the case west of the Méchi, or be not so divided owing to the absence of that range, as is always the fact east of the Méchi. Again, *every where* there is, at that point where this vast bed of gravel and sand thins out, a constantly moist tract, caused by the percolation of hill waters through the said bed, and their issue beyond it; and that constantly moist tract is the Tarai, whether it run regularly parallel to the line of mountains and be distinctly troughed, as to the westward is the case, or, whether there be no such regularity of parallelism or of troughing, as to the eastward is the case.

*Why* that vast mass of porous debris which every where constitutes the appropriated domain of the Saul forest, and that imporous trough outside of it which every where constitutes its drain, should, as far eastward as the Méchi, be both of them developed parallelly to each other and to the line of the mountains, whilst beyond the Méchi eastward to Assam (exclusive) they should exhibit little or no such parallelism, but should rather show themselves plainwards, like an irregular series of salient and resalient angles resting on the mountains, or like small insulated plateaux,\* or high undulated plains,† surrounded in both the latter cases by low swampy land analogous to the Tarai, it would require a volume to illustrate in detail. I have given a few conspicuous instances in the foot notes. For the rest it must suffice to observe that such are the general appearances of the Bháver and Tarai

\* Parbat Jowár, on the confines of Assam and Rangpúr, is one of the most remarkable of these small plateaux. It is considerably elevated, quite insulated, remote from the mountains, and covered with Saul, which the low level around exhibits no trace of. Parbat Jowár is a fragmentary relic of the high level or Bháver, to which the Saul tree adheres with undeviating uniformity.

† Conspicuous instances occur round Dinájpúr and N. W. and N. E. of Siligori in Rangpúr, where are found highly undulated downs, here and there varied by flat-topped detached hillocks, keeping the level of the loftiest part of the undulated surface. Looking into the clear bed of the Tishta it struck Dr. Hooker and myself at the same moment, how perfectly the bed of the river represented in miniature the conformation of these tracts, demonstrating to the eye their mode of origination under the sea.

to the westward and to the eastward ; and that the general causes of the differences have been pretty plainly indicated above, where the necessary effects of the sandstone range and of the eastern dip of the plains upon those oceanic forces to which all the phænomena of the region owe their origin, have been suggested.

Throughout Assam, from Gwalpára to Saddia, Major Jenkins assures me there is neither Bháver nor Tarai ; and if we look to the narrowness of that valley between the Himálaya and the mighty and impetuous Brahmaputra, and consider moreover the turmoil and violence of the oceanic current from the N. W., when its progress was staid by the locked-up valley of Assam, we shall be at no loss to conceive how all distinctive marks of Bháver and Tarai should here cease to be traceable.

It will be observed that in the foregone descriptions of our Himálayan rivers I have not adverted (save casually in one instance, in order to correct an error as to the true name of the Káli) to their partial trans-Himálayan sources. And I confess it seems to me that perspicuity is by no means served by undue insistency on that feature of our rivers. Capt. Herbert was thus led to travel beyond his proper limits with a result by no means favourable ; for, it appears to me that he has confounded rather than cleared our conceptions of Asie Centrale as the Bám-i-dúnya (dome of the world) by attempting to detach therefrom that most characteristic part of it, the plateau of Tibet, *because* certain Indian rivers have (in part) Tibetan sources ! My theory of watersheds does not incline me thus to violate the grander arrangements of nature, and the less so, inasmuch as the rivers I have to speak of would not afford so plausible an excuse for such violation, as if I had to treat of the Indus, Sutledge\* and Brahmaputra alias Sápú.† The Arún and the Karnáli, though they draw much water from Tibet, draw far more from the pente meridionale of the Himálaya, or the ghát line

\* Recte Satlúj vel Satrúdra.

† Mr. Gutzlaff, in a paper recently read before the Geographical Society of London, has reverted to Klaproth's notion that the Sápú is not the Brahmaputra. But Mr. Gutzlaff has overlooked J. Prinsep's important, and I think decisive argument on the other side, viz., that the Brahmaputra discharges three times more water than the Ganges, which it could not do if it arose on the N. E. confines of Assam, notwithstanding the large quantity of water contributed by the Monás.

and all south of it; and this is yet more true of the Ganges, the Monás and the Tishta, though they also have partial trans-Himálayan sources. To those sources of the several Himálayan (so I must call them) rivers above treated of I will now summarily advert.

*The Monás.*—It is by much the largest river of Bhútán, which state is almost wholly drained by it. It has, (it is said) two Tibetan sources, one from lake Palté vel Yarbroyum, which is a real lake, and not an island surrounded by a ring of water as commonly alleged—the other, from considerably to the west of Palté. These feeders I take to be identical with Klapproth's Mon tchú and Nai tchú vel Lúbnak tchú, strangely though he has dislocated them.

*The Tishta* is also a fine river, draining the whole of Sikim save the tracts verging on the plains. The Tishta has one Tibetan source, also from a lake, viz. that of Chólámú. To speak more precisely, there are several lakelets so named, and they lie close under the N. W. shoulder of Powhanry, some 30 miles W. and 40 S. of Turner's lakes.

*The Arún* is the largest of all the Himálayan rivers, with abundant cis-Himálayan and three trans-Himalayan feeders. One, the western, rises from the pente septentrionale of the Himálaya, in the district of Tingri; another, the northern, from a place called Dúrré; and a third, the eastern, from the undulated terraced and broken tract lying N. and a little W. of Cholamu, and S. of Kambala or the great range which bounds the valley of the Yaru ou the S. from W. of Digarchi to E. of Lassa.

*The Karnáli* is much larger than the Alpine Ganges, and nearly equal to the Arún, perhaps quite so. It drains the whole Himálaya between the Nanda-dévi and Dhoula-giri peaks, and has one considerable Tibetan source deduced either from the north face of Himáchal near Momonángli or from the east face of that crescented sweep whereby Gangri nears Himáchal, and whence the Karnáli flows eastward to the Taklakhár pass.

*The Ganges* also has of late been discovered to have one Tibetan feeder, viz. the Jáhnavi, which, after traversing a good deal of broken country in Gnári between the Sutledge and the Himálaya, passes that chain at the Nilang ghát to join the Bhágarathi.\*

\* Moorcroft's Travels. J. A. S. No. 126, and I. S. R. Nos. 17, 18.

I will conclude this paper with the following amended comparative table of Andean and Himálayan peaks, Baron Humboldt having apprised me that Pentland's measurements, as formerly given by me, have been proved to be quite erroneous, and Col. Waugh having recently fixed Kangchang and Chumalári with unrivalled precision and accuracy.

<i>Chief Peaks of Andes.</i>	<i>Feet.</i>	<i>Chief Peaks of Himalaya.</i>	<i>Feet.</i>
Aconcagua, . . . . .	23,000	Jamnoutri, . . . . .	25,669
Chimbarazo, . . . . .	21,424	Nanda-devi, . . . . .	25,598
Sorato, . . . . .	21,286	Dhoula-giri, . . . . .	27,600
Illimani, . . . . .	21,149	Gosain-than, . . . . .	24,700
Descabado, . . . . .	21,100	Kangchang, . . . . .	28,176
Desya-cassada, . . . . .	19,570	Chumalári, . . . . .	23,929

#### POSTSCRIPT.

That sensible and agreeable writer, Major Madden, in a letter just received by Dr. Hooker, notices "the disgraceful state of our maps of the Himálaya, which insert ridges where none exist, and omit them where they do exist; and, moreover, in regard to all names, show an utter ignorance of the meaning of Indian words." It is the express object of the above Essay to contribute towards the removal of the weightier of those blemishes of our maps without neglecting the lesser, by exhibiting, in their true and causal connexion, the great elevations and the river basins of the Himálaya. Major Maddeu supposes that the term Hyún dés, which he applies to Tibet, points to that region as the pristine abode of the Huns. But this is a mistake. Hyún dés is a term unkuown to the language of Tibet. It is the equivalent in the Khas or Parbatia language for the Sanscrit Himyá dés, or land of snow. Its correlative term in the Parbatia tongue is Khas dés, or land of the Khas. The Khas race were till lately (1816) dominant from the Satlege to the Tishta: they are so still from the Káli to the Méchi. Hence the general prevalence of geographic terms derived from their language. By Hyún dés the Parbatias mean all the tracts covered ordinarily with snow on both sides of the crest or spine of Hemáchal, or the ghat line; and by Khas dés, all the unsnowed regions south of the former, as far as the sandstone range.

The bráhmans and those who use Sanscrit call the Hyún dés, Bhútánt or appendage of Bhót; and hence our maps exhibit a Bhútánt in

what Traill denominates (A. R. Vol. 16) the Bhote pergunahs of Kúmáon. But, Bhútánt is not restricted by the bráhmans to such pergunahs in Kúmáon merely, far less to any one spot within them. It includes all the districts similarly situated along the entire line of the Himálaya. We might create confusion however by recurring to this extended meaning of the word, since it has long been restricted by us to the Déb Rájah's territory, or Bhútán (recte Bhutánt). Moorcroft's Giannak in Western Tibet is the ne plus ultra of abuse of words. Far to the East, some Bhótia must have told him, lie the Giannak or Chinese, and thereupon he incontinently gives this term as a name of a place.

The Tibetans call their neighbours by the generic name Gia, to which they add distinctive affixes, as Gia nak, black Gias, alias Chinese; Gia-ver, red Gias, alias Russians; and Gia-gar, yellow Gias, alias Hindús. With reference to the Huns, if I were in search of *them* in Tibet, I should look for them among the Hór of that country, as I would for the Scythians among the Sóg vel Sók. Sogdiana or Sóg-land was, I conceive, the original *Σακεια* the first known historic seat of the Indian Sákás and Tibetan Sóg, vel Sók. Hórsók as one term, means Nomade in Tibetan, such being still the condition of those two tribes in Tibet.



*On Native impressions regarding the Natural History of certain Animals, by H. TORRENS, Esq. B. A. V. P. &c.*

The singular impressions current among natives even of the highest rank, as to the habits and nature of certain animals are not undeserving of record. It is rarely that the credence of the narrators in these things can be elicited, if even they go so far as to mention the existence of the belief; for they dread the ridicule as much as they anticipate the incredulity of a European: consequently these strange stories are but imperfectly known, even to the best informed among us in such legends. I mention one or two with the circumstances of my acquaintance with them.

While out tiger-shooting with a party of Musalman gentlemen, I was asked, in a confidential way, whether I had ever seen the *phnew*: I spell the word with the almost undescribable nasal aspirate with which it was invariably pronounced to me. With an air of grave and serious interest, which is the best way of inspiring confidence, I replied that



the nature of the thing or being, was unknown to me, and I requested information on the subject. On this there was a little hesitation, when after a time it was explained, that as I had seen more of tigers than my companions, they fancied I might have also seen or heard something of the animal that always preceded the tiger, called *phnew* from the ceaseless iteration of a sound similar to its name. I required further enlightenment as to this creature, when I found it was a "something that preceded the tiger by six cubits, wherever he went, making the noise *phnew* without end, looking for things for it." The old tales of 'the lion and his provider' recurred to me at once; and I bethought me of the hospitality of some cat-like sound of *felis tigris* having led, during his nightly search for prey, to the creation of the story. I have done all I could, but in vain, to discover whether there were real grounds for the belief, based on such a habit of the animal. I killed several tigers in company with my friends afterwards, but though we found no *phnew* with any of them, the silent faith of my believers in the marvellous, has remained unshaken as to the existence of the mysterious animal. I subsequently learned that there is in Bengal a like belief respecting it among the Hindus, who term the creature *ghóg*.\*

There are few Englishmen in India who have not perhaps heard some of the strange tales related by the natives regarding serpents. The most remarkable to me, has always been the belief in the *Raj Samp*, or king snake, who is represented as belonging to a superior order of serpent, as exacting homage and obedience from his ophite subjects, and, sometimes, as appearing with the semblance of a crown, the type of his authority. I was one day in company with a number of native gentlemen, when the conversation turned upon the nature of antidotes in the case of snake bites, the belief as to the cure effected, by applying to the wound, the head of the identical reptile that had inflicted it, the charms powerful to compel the snake to appear,—as to all which matters I have never been able to obtain, amid many tales, any relator daring enough to declare himself an eye-witness of the marvels he recounted. At last, mention being made of the King Snake, a party present said,—'At any rate I can assure you of the existence of *him*, for it is well known that I have seen,' and the story, to the following

\* According to Babu Rajendralál Mitra, the Hindus distinguish the *Ghóg* as a different animal from the *P'heu*.—E. B.

effect was then told. The narrator, being at that time he said, about fourteen years old, had run hastily to the terraced roof of a ground floor house to recover his kite, when his attention was attracted by a large *goomna* (cobra capello) which, without perceiving him, raised itself with dilated hood in the erect attitude common with those snakes, and uttered a loud cry. Immediately some ten or twelve snakes appeared from different quarters, and assembled before their king; when after a short time, he pounced upon, and devoured one of the smaller ones, with which arbitrary assertion of regal power the convocation terminated. Now the narrator of this tale had no interest in attempting to mislead me; he had mentioned what he stated again and again, to the majority of persons present for years, before I ever saw him; and he is naturally of intelligence, and in no sort the man to tell a useless falsehood. It is, I was then informed, by these sort of assemblages that the king snake asserts his power, and that his subjects are called to them for the purpose of bringing tribute, in the shape of dainties for the royal palate; should however no tributary frog or cat, or bird be forthcoming, or should even the offering produced be insufficient, one of the luckless ophids, pays in person the penalty of the omission,—even as had been witnessed by my informant.

I ventured with respect to his story to object, in as delicate a way as I could, to the incident of the cry uttered by the king snake, but in this I was immediately over-ridden. The cry of the large *goomna* was well-known in the ruinous city where we were, and in which they abound, and it was described to me as a strident sound, the attempted imitation of which resembled the acute staccato note of a treble hant-boy. I heard this sound myself subsequently during a sleepless night, emitted by a large snake which killed a rat in my bed room: as it was pitch dark I was unable to rise and destroy the intruder, but the sound was too peculiar not to have been that of the ophid, according as it did with the description given me, and being unlike any thing I ever heard before, as also contrasting distinctly and remarkably with the cries of its victim.

I have noted down these trivial, but not incurious matters as an inducement to the record of more valuable facts as to the opinions held by natives upon the habits of animals, whence perhaps some really useful information may be elicited.

NOTE by Mr. Blyth.—The snake which I have had invariably pointed out to me, as the *Raj Samp* by natives of Bengal is *Bungarus annularis*, which habitually preys upon other snakes, and is currently said to be a deadly enemy of the Cobra. I have taken a *Tropidonatus umbratus* about two-thirds the length of its devourer, from the stomach of this species, and the specimen is stuffed in the Society's Museum as in the act of seizing its victim which it had swallowed. Another ophiophagous species, with the Cobra hood, is *Hamadryas hamah* of Cantor, or *Maia vettata* of Elliot; a specimen of which (9 ft. long, and now mounted in the Museum), I obtained in the Midnapore jungle.

Mr. Layard some time ago informed me of a popular notion among the natives of Ceylon respecting a "horn" which is said to grow sometimes, but very rarely on the forehead of the jackal; and this horn is regarded by them as a specific of innumerable virtues. Strange to say, the same notion is equally current among the natives of Bengal, who believe that it ensures the prosperity of its possessor, and success in every undertaking.—E. B.



*On the Influence of Forests on Climate.\** By Lieut. W. H. PARISH,  
B. A. (Communicated by Sir H. M. ELLIOTT, K. C. B. Sec. to the  
Govt. of India.)

The influence of forests in modifying the climate of the globe, may fitly be considered in this place, more especially as the subject has of late attracted much attention in this country. I shall confine myself however to merely recording in this brief notice the opinions of such scientific men as have devoted much of their time to the investigation of this important subject.

There can be no doubt that the state of the climate, especially the humidity of the atmosphere, influences vegetation, and that in its turn vegetation re-acts upon the climate, but too much importance has been attributed to the influence of forests, as if they were the principal cause of the moisture of the climate. The felling of forests has doubtless been attended, in many countries, by a diminution of rain, as in Barbadoes and Jamaica. In the Mauritius also, the rivers were found

\* This forms an Appendix to the Author's *Journal of a Trip to the Kohistan of the Jullunder* published in the April No. of the Journal.

to be diminishing on account of the rapid disappearance of the woods in the interior, when government had recourse to the measure of prohibiting their further destruction, and they rapidly recovered their former dimensions. In fact in all tropical countries, where the quantity of aqueous vapour in the atmosphere is great, but where on the other hand, the direct rays of the sun are most powerful, any impediment to the free circulation of the air, or any screen which shades the earth from the solar rays, becomes a source of humidity, and wherever dampness and cold have begun to be generated by such causes, the condensation of vapour continues. The leaves moreover of all plants are alembics, and some of those in the torrid zone have the remarkable property of distilling water, thus contributing to prevent the earth from becoming parched.

But there are various circumstances which may contribute towards the formation of rain, and to which I have alluded in the preceding remarks; temperature, pressure of the atmosphere and its electrical state, are the chief agents; mountain chains and forests form local causes.

The effect which forests exercise upon the condensation of vapours has been ably treated by Daniell, in his *Meteorological Essays*.

“Humboldt considers that forests exercise a triple influence upon climate—first they protect the soil against the rays of the sun; secondly, they produce, by the vital activity of their leaves, a constant evaporation of aqueous vapours; thirdly, these leaves increase the radiation. These three simultaneous causes, as affording shade, evaporation, and radiation, are so influential that the knowledge of the extent of forests compared with the naked savannahs, steppes and champaign ground, forms one of the most important elements in the climatology of a country. The active vitality of plants consists chiefly in the leaves; they are the organs of respiration, digestion and nutrition. The great quantity of water which they perspire may be easily proved by placing a glass next the under-surface of a young vine leaf on a hot day, and it will be found to perspire so copiously, that the glass will be in a short time covered with dew, which runs down in streams in half an hour. Hales computed the perspiration of plants to be seventeen times more than the human body; he calculated that the leaves of a single helianthus, 3 feet and  $\frac{1}{2}$  in height, covered 40 square feet, and comparing his former

observation of the perspiration of leaves with this circumstance, Humboldt observes properly, if a plant of such small size exercises influence upon evaporation, how much greater must be the perspiration of the forests of the Upper Orinoco, which cover 2,60,000 nautical square miles! The cloudy and misty sky of those regions, and of the Province of Las Esmeraldas, to the west of the Volcano of Pichinche, the decrease of the temperature in the missions on the Rio Negro, and the streams of vapour which become visible on fixing the eyes on the tops of the trees in the Equatorial forests, must be alike ascribed to the aqueous exhalation of the leaves and to their radiation towards the space of the atmosphere. \* \* \* \* \*

“It is asserted that there is at present much less rain in Barbadoes than there was formerly, and many of the inhabitants ascribe it to the unlimited clearance of forest and brushwood, and although we have no direct reasons to prove why such clearances lessen the annual quantity of rain, we have abundant proof that it is so. In every instance and in every part of the globe where forests have been cleared, a diminution of aqueous precipitations has been noted; and as it is a fact which remains uncontested, that Barbadoes, within the last fifty years was much more wooded than it is now, the diminution of rain must likewise be expected as the natural effect. The evidence of Humboldt, Leopold de Buck, Daniell, Dove, and others, is so powerful on this subject, that I should wish to press particularly upon the attention of the reader how important the existence of wooded spots become to the agriculturist. I cannot do better than quote the words of Humboldt to enforce this view:—“By felling the trees that cover the tops and the sides of mountains, men in every climate prepare at once two calamities for future generations—the want of fuel and a scarcity of water; trees, by the nature of their perspiration, and radiation from their leaves in a sky without clouds, surround themselves with an atmosphere constantly cool and misty.”

Again, that forests exist in those parts only where the predominant winds carry with them a considerable quantity of moisture, and consequently that they are not the primary cause of humidity, is rendered highly probable from the following consideration:—

“In all countries having a summer heat exceeding 70° the pre-

\* Maclaren, Art. America. Encyc. Britannica.

sence or absence of natural woods, and their greater or less luxuriance, may be taken as a measure of the amount of humidity, and of the fertility of the soil ; short and heavy rains in a warm country will produce grass, which having its roots near the surface springs up in a few days, and withers when the moisture is exhausted, but transitory rains, however heavy, will not nourish trees, because, after the surface is saturated with water, the rest runs off, and the moisture lodged in the soil neither sinks deep enough, nor is in sufficient quantity to furnish the giants of the forest with the necessary sustenance. It may be assumed that 20 inches of rain falling moderately, or at intervals, will leave a greater permanent supply in the soil than 40 inches falling as it sometimes does in the torrid zone in as many hours."

"In all regions," he continues, "where ranges of mountains intercept the course of the constant or the predominant winds, the country on the windward side of the mountains will be moist, and that on the leeward dry, and hence parched deserts will generally be found on the west side of countries within the tropics, and on the east side of those beyond them ; the prevailing winds in these cases being generally in opposite directions. On this principle the position of forests in North and South America may be explained. Thus for example, in the region within the thirtieth parallel, the moisture swept up by the trade wind from the Atlantic is precipitated in part upon the mountains of Brazil, which are but low and so distributed as to extend far into the interior. The portion which remains is borne westward, and losing a little as it proceeds, is at length arrested by the Andes, where it falls down in showers on their summits. The Aerial current, now deprived of all the humidity with which it can part, arrives in a state of complete exsiccation at Peru, where consequently no rain falls. In the same manner the Ghauts in Hindoostan, a chain only three or four thousand feet high,\* intercept the whole moisture of the atmosphere, having copious rains on their windward side, while on the other the weather remains clear and dry. The rains in this case change regularly from the west side to the east, and vice versâ with the monsoons. But in the region of America, beyond the thirtieth parallel, the Andes serve as a screen to intercept the moisture brought by the prevailing winds from the Pacific Ocean ; rains are copious on their summits, and in

\* Five or six thousand ?

Chili on their western declivities, but none falls on the plains to the eastward except occasionally, when the wind blows from the Atlantic."

Again, Dr. Daubeny has ascertained by experiments communicated to the British Association, that plants undoubtedly exercise a purifying influence on the atmosphere. In a letter to Dr. John Lindley, he expresses himself thus :\*—

"As the observations of Ellis left it in some doubt whether the balance was in favour of the purifying or the deteriorating influence upon the air which is exercised by plants during different portions of the day and night, I conducted my experiments in such a manner that a plant might be inclosed in a jar for several successive days and nights, whilst the quality of the air was examined at least two or three times a day, and fresh carbonic acid admitted as required. A register being kept of the proportion of oxygen each time the air was examined, as well as of the quantity of carbonic acid introduced, it was invariably found that, so long as the plant continued healthy, the oxygen went on increasing, the diminution by night being more than counter-balanced by the gain during the day. This continued until signs of unhealthiness appeared in the confined plant, when of course the oxygen began to decrease."

"In a perfectly healthy and natural state, it is probable that the purifying influence of a plant is much greater, for when I introduced successively different plants into the same air, at intervals of only a few hours, the amount of oxygen was much more rapidly increased, in one instance to more than 40 per cent. of the whole, instead of twenty as in the air we breathe."

"Thus the vegetable kingdom may be considered as a special provision of nature to consume that which would render the world uninhabitable by man, and to have been so beautifully contrived that its existence depends upon its perpetual abstraction of that, without the removal of which our own existence could not be maintained. But although this is true of green plants, it does not appear to be so, of Fungi. Marcey has shewn from carefully conducted experiments, that Mushrooms, vegetating in atmospheric air, produce on that air very different modifications from those of green plants in analogous situations, in fact, that they vitiate the air promptly, either by absorbing

\* Vide Lindley's Introduction to Botany, p. 378, 3rd Edition.

its oxygen to form carbonic acid at the expense of the carbon of the vegetable, or by disengaging carbonic acid formed in various ways. That the modifications which the atmosphere experiences when in contact with growing mushrooms are the same day and night. That if fresh mushrooms are placed in an atmosphere of pure oxygen, a great part of that gas disappears at the end of a few hours. One portion of oxygen which is absorbed combines with the carbon of the plant to form carbonic acid, whilst another part appears to be fixed in the vegetable, and to be replaced, at least in part, by nitrogen disengaged by the mushroom. That when fresh mushrooms remain some hours in an atmosphere of nitrogen, they modify but slightly the nature of that gas. The sole effect produced is confined to the disengagement of a small quantity of carbonic acid, and sometimes to the absorption of a very small quantity of nitrogen."

No application of human skill and labour tends so greatly to vary the state of the habitable surface, as that employed in the drainage of lakes and marches, since not only the localities of many animals and plants, but the general climate of a district, may thus be modified. There seems little doubt that in the United States the rapid "clearing" of the country has rendered the winters less severe and the summers less hot, in other words the extreme temperatures of January and July have been observed from year to year to approach somewhat nearer to each other, and thus most probably, the mean temperature has been raised. The same result has been brought about in this country, only to a much greater extent.

The entire destruction of all woods and forests has rendered India liable to those dreadful calamities which always follow a deficiency of rain.

The N. W. Provinces were denuded of their trees during the wars that attended the decline and fall of the Muhammedan Empire, and the rise and progress of the Jats, Seikhs and Mahrattas. These lawless freebooters swept away all the groves from the face of every district they invaded, whilst they never thought of renewing them, or encouraging their renewal, in those countries which they permanently occupied; many fertile regions were thus turned into dreary and arid wastes.

It is marvellous to think how slowly and reluctantly the Indian Government has come forward and acknowledged the necessity for that merciful provision of nature by which the thirsty soil is refreshed with grateful drafts and rendered habitable by mau. Trees perform as



important functions, and are as indispensable in the economy of nature as the liquid air which encircles our globe, or the mighty ocean which lashes its shores.

“The carbonic acid with which our breathing fills the air, to-morrow will be spreading north and south and striving to make the tour of the world. The date trees that grow round the fountains of the Nile will drink it in by their leaves; the Cedars of Lebanon will take of it to add to their stature, the cocoa-nuts of Tahiti will grow riper upon it, and the palms and bananas of Japan will change it into flowers.”

“The oxygen we are breathing was distilled for us some short time ago by the magnolias of the Susquehanna and the great trees that skirt the Orinoco and the Amazon. The giant rhododendrons of the Himalayas contributed to it, the roses and myrtles of Cashmír, the cinnamon trees of Ceylon, and forests older than the flood, buried deep in the heart of Africa far behind the mountains of the moon. The rain which we see descending was thawed for us out of icebergs which have watched the polar star for ages, and lotus lilies sucked up from the Nile and exhaled as vapour the snows that are lying on the tops of our hills.”\*

Among the many causes which produce certain modifications in the climate of any region, and one which is too frequently overlooked, is *the nature of the soil*. This is principally owing to the greater or less power any soil possesses of radiating heat. Thus sandy soils are subject to become rapidly and intensely heated, and when the rays of the sun are withdrawn, they readily radiate or impart to the atmosphere the heat they have acquired, thus increasing the general temperature. Clayey soils on the other hand become slowly heated, and as slowly part with heat; swampy ground chills the air, and extensive forest tracts have a similar effect. And thus cultivation not unfrequently effects a change in the climate of a country, for if marshes are drained, or forests cleared, the temperature will be raised. It thus appears that the diversities of climate are brought about by various causes, and are chiefly dependant on latitude; on the distribution of land and water; on the elevation of land above the sea, as also on the nature of the soil, the prevalence of particular winds, and position of forest, on currents of the ocean, on the direction and extent of mountain ranges, and many other local circumstances.

\* British Quarterly Mag.

The present denuded state of the N. W. Provinces has, I believe, lately attracted the attention of government, and therefore it may not be amiss to note down here the plans that have suggested themselves for restoring to the soil what nature designed for its protection and benefit.

In the first place it appears necessary that the government should set the good example to its subjects by cutting canals, planting trees and digging wells at every ten or twelve miles along the principal thoroughfares of these provinces; and moreover it should adopt measures for their protection, and prevent the groves from being destroyed for the purposes of feeding camels and elephants, as well as for supplying fuel for Military Stations.

The extensive dawk (*Butea frondosa*) jungle, situated between Phugwara and Khanora, in the Jullundhur Doab, is fast disappearing, and in a very few years no traces of it will be left. The same may be said of the pine forests in our Himalayan Provinces.

On each occasion that I have marched through the above mentioned Doab, I have been sorely grieved to mark how the venerable peepul and banyau trees planted for the purpose of affording shade to the weary traveller, have been ruthlessly mutilated in order to feed the camels and elephants belonging to Europeans and the government. That picturesque Doab will soon become as dreary and as uaked as any of the Upper Provinces, if some protecting hand is not immediately stretched out to prevent its spoliation. In the next place, the government should foster and encourage, or rather turu to some useful purpose the religious vanity of the Hindus, by granting them certain portions of rent-free land in perpetuity whereon to plant groves and dig wells for the benefit of their souls, and to the greater advantage of travellers.

“To live in the grateful recollections of their countrymen for benefits conferred upon them in great works of ornament and utility, is the study of every Hindu of rank and property. Such works tend in his opinion, not only to spread and perpetuate his name in this world, but through the good wishes and prayers of those who are benefitted by them, to secure the favour of the deity in the next.

“According to their notions every drop of rain water or dew that falls to the ground from the green leaf of a fruit tree, planted by them

for the common good, proves a refreshing draft for their souls in the next. When no descendants remain to pour the funeral libation in their name, the water from the trees they have planted for the public good is destined to supply its place ; every thing judiciously laid out to promote the happiness of their fellow-creatures will in the next world be repaid tenfold by the deity.”\*

“ If government wishes to have the Upper Doab, the Delhi, Muttra and Agra districts again enriched and embellished with mango groves, they will not delay to convey this feeling to the hundreds, nay thousands who would be willing and anxious to plant them upon a single guarantee that the lands upon which the trees stand shall be considered to belong to them and their heirs as long as these trees stand upon them. That the land, the shade, the fruit, and the water will be left to the free enjoyment of the public, one may take for granted, since the good which the planter’s soul is to derive from such a work in the next world must depend upon their being so ; and all that is required to be stipulated for in such grants, is that mango, tamarind, peepul or bur trees, at the rate of twenty-five the English acre, shall be planted and kept up in every piece of land granted for that purpose ; and that a well of pukka masonry shall be made for the purpose of watering them, in the smallest as well as in the largest piece of ground granted, and kept always in repair.

“ If the grantee fulfil the conditions, he ought, in order to cover part of the expense, to be permitted to till the land under the trees until they grow to maturity and yield their fruit ; if he fails, the lands, having been declared liable to resumption, should be resumed.

“ The person soliciting such grants should be required to certify in his application that he had already obtained the sanction of the present lessee of the village in which he wishes to have his grove, and for this sanction he would of course have to pay the full value of the land for the period of his lease. When his lease expires, the land in which the grove is planted would be excluded from the assessment ; and when it is considered that every good grove must cost the planter more than 50 times the annual rent of the land, government may be satisfied that they secure the advantage to their people at a very cheap rate.”†

\* *Rambles and Recollections of an Indan Official*, p. 191, Vol. 2.

† *Ibid*, p. 197, Vol. 2.

*A Supplemental Note to the Catalogue of the Birds in the Asiatic Society's Museum;\** by E. BLYTH, Esq.

NO. 1818. *CACATUA CITRINO-CRISTATA*; *Plyctolophus citrino-cristatus*, Fraser, *P. Z. S.* 1844, p. 39. Except that Mr. Fraser states that this species is about the size of *C. sulphurea*, his description of it would equally apply to *C. galerita*, which indeed it very closely resembles, except in its much inferior size. It is larger, however, than *C. sulphurea*, and has a much higher crest; while its beak is considerably smaller and more compressed than in that species, having a much narrower culmen to the upper mandible, but the lower being as broad as in *C. sulphurea*, with a medial groove instead of a convexity. Colour exactly as in *C. galerita*; and length of closed wing  $10\frac{3}{4}$  in., and of crest  $4\frac{3}{4}$  in. Habitat unknown.

NO. 1833. *PALEORNIS CALTHRAPÆ*, Layard. A beautiful species, the representative in the mountainous parts of Ceylon of *P. columboides* of the Nilgiris, to which species it manifests the nearest affinity. Crown and back plumbeous-grey, passing to bluish on the rump, and rich dark indigo-blue on the middle tail-feathers and outer webs of the rest: tail yellow beneath and at the tips, sullied along the inner webs of the rectrices above: forehead and cheeks (passing beyond the eye), broad nuchal ring, and entire under parts, brilliant green: wings deeper green, paler and yellowish towards the scapularies: throat intense black and contrasting, with a tendency to form a ring round the neck, but which does not so much as half surround the neck. Upper mandible bright coral, with a white tip; the lower reddish. Wing  $5\frac{1}{2}$  in.: tail probably of the usual length, but its medial feathers in the specimen described appear but half-grown. A female or young male is wholly green, more yellowish below, except the rump which is brighter blue than in the adult male, and the tail is mingled green and indigo-blue; the more vivid green ring of the neck but obscurely indicated. Both the mandibles are dull coral, with white tips; and the wing measures  $5\frac{1}{4}$  in., the tail but  $4\frac{1}{2}$  in.

\* The species included in this paper are, almost without exception, comprised in the printed Catalogue of the collection of Birds in the Society's Museum, each with a reference to Vol. XVIII, of its Journal, and their numbers in the Catalogue are here prefixed.

Inhabits the Kandyan country, in Ceylon. Nothing can exceed the harmony and delicate beauty of its colouring.

No. 1820. LORICULUS ASIATICUS; *Psittacus asiaticus*, Latham, and *Ps. indicus*, Gmelin,—both founded on Edwards, pl. 6, which is a good representation. The names, however, are bad, as the race would seem to be wholly confined to Ceylon: while *L. vernalis* inhabits all India, and the countries bordering the eastern shores of the Bay of Bengal, as far as the Tenasserim provinces where it abounds, and also Java; whereas in the Malayan peninsula there appears only to be *L. galgulus*. *L. asiaticus* differs from *L. vernalis* in having the crown deep red, passing to a saffron hue on the nape, and in some specimens over much of the back; while the fore-part of the neck is tinged more or less deeply with verditer. The nearest affinity of these Loricules is with the genus *Electus*;\* and there are other species in the Philippines and probably the south of China.

No. 99. MICRASTUR—? Size of full grown young male *Astur palumbarius*, and plumage scarcely differing; but the tail shorter, and the tarse longer and more slender. The markings of the under-parts are also less narrow, forming pear-shaped drops, small and rounded on the belly, lower tail-coverts, and tibial plumes,—much as in the young *M. badius*: under surface of the primaries (as seen in the closed wing) almost unbarred; their emarginated portion plain brown; the rest of the inner webs having narrow bars, which are distinct from the fifth inwards and throughout the secondaries and tertiaries; above, the primaries are albescent-rufous at base, with their outer webs barred from the third inwards: tail with numerous (8 or 9) transverse dark bands, narrow towards its base and broadening to the last; the longer upper coverts of the tail also distinctly banded. Length of closed wing 13 in.; of tail 9 in.; and tarse 3 in., the latter plumed for about  $\frac{1}{4}$ . Habitat unknown: not improbably American.

No. 171, *d*; p. 340: and No. 172. STRIX PUSILLA, nobis. Distinguished at a glance from *Str. flammea* by its general smaller size, conspicuously smaller facial ruff, and shorter and more slender tarsi and toes. A specimen received from England (but not supposed to be Eng-

\* *Psittacus sumatranus*, Raffles, erroneously referred by Mr. G. R. Gray to this genus, seems merely to be the female of *Taenygnathus macrorhynchos*, which is closely affined to *Palæornis*.

lish) was doubtfully referred to the Australian *Str. delicatula*, Gould, in *J. A. S.* XVII, 346 ; but Mr. Strickland (*in epistolá*) assures me that it is not *delicatula*. Another, like it, but  $1\frac{1}{4}$  in. longer in the wing, has since been received from Mr. Layard, who informs me that this specimen came from Egypt : but the latter may either exhibit the extreme of variation of colouring as compared with the former, or they may be of two small races closely affined to each other and to *Str. flammea*, in which case the name *parva* may be bestowed on the Egyptian race, and *pusilla* on the other (the habitat of which is unknown). The latter, or that formerly described, resembles the most ashy specimens of *Str. flammea* above, except that the white spots bordered with black are less defined ; and below it is white, with the usual small blackish dots : primaries and tail barred exactly as in several specimens of *Str. flammea* with which we have compared it. The Egyptian specimen resembles the more fulvous examples of *Str. flammea* above, having much less of the ashy mottling than the other ; below it is white with minute dusky specks ; and the outermost and penultimate tail-feathers are wholly unbarred underneath, causing the lower surface of the tail to appear quite white : the primaries are very faintly banded on their outer webs, but the bars on their inner webs are unusually black ; and the bands upon the tail as seen above are much more faint than usual. In both, the tarsi measure but  $2\frac{1}{4}$  in. (instead of  $2\frac{1}{2}$  in. and upwards), and are conspicuously less robust than in *Str. flammea*. Notwithstanding the differences of the two specimens, we suspect that they pertain to the same small race or species.

No. 178. BUCEROS AFFINIS, Hutton. This perfectly resembles *B. albirostris* (No. 179), except that it is constantly of the considerably larger size of *B. pica* (No. 177). Inhabits the Deyra Doon. The large bill and casque noticed in XVI, 994, pertain decidedly to this race.

There are accordingly now the following series of species or permanent races liable to be confounded together under *B. pica* vel *malabaricus*, auctorum.

1. *B. pica* (No. 177). Distinguished by its comparatively large size, highly compressed casque with great black patch not descending upon the upper mandible, and four white tail-feathers on each side. Inhabits all the peninsula from central India southward, and Ceylon ? At least a head from the latter country is undistinguishable ; but the Cinghalese

race (*B. violaceus*, auct.) is described to have constantly only three of its outer tail-feathers on each side white.

2. *B. albirostris*, Shaw (No. 179), vide *J. A. S.* XVI, 994. From Bengal, Nepal, Asám, Sylhet, Arakan, and the Tenasserim provinces. Great numbers of specimens examined, present no remarkable variation of size, and certainly never approach the dimensions of the Deyra Doon race.

3. *B. affinis* (No. 178).

4. *B. intermedius*, nobis (No. 180), vide *J. A. S.* XVI, 994. Like No. 179, but with the tail of No. 177. This race is very abundant about Pinang, but we have never seen it from Malacca or Singapore. It is probably the Sumatran *malabaricus* of Raffles, the Javanese *albirostris* of Horsfield, and the general Malayan *malabaricus* of Temminck and others.

5? *B. violaceus*, Shaw, and of Wagler? (*Non vidimus.*) From Ceylon.—*B. malayanus* (No. 181) is also nearly affined, but too different to be confounded with either of the others; and *B. nigrirostris* (No. 182) is certainly distinct, and is referred to by Dr. S. Muller as a permanent variety of No. 181.\*

Genus *Picus*, L., as restricted to the pied species forming the division *Dendrocopus* of Swainson. The Indian species of this group are treated of in XIV, 196, so far as we were then cognisant of them. We have since learned of two others described from the "Himalaya," viz. *P. assimilis*, Natterer,—like *P. himalayanus* (No. 287), but with the scapulary feathers white, and some other distinctions,—and *P. scintilla*, Lichtenstein,—which considerably resembles *P. pygmaeus* (No. 300), except in being very much larger. We have now to add

No. 1825. *P. atratus*, nobis. Resembles *P. Macei*, but is larger, with no fulvescent-white on the sides of the head and neck, except some admixture of it on the lores, ear-coverts, and above the eye. Lower-parts black, the feathers laterally edged with dingy golden-fulvous, confused and intermixed on the abdomen, and the black gener-

\* This author gives four varieties of *B. rhinoceros*, respectively from Sumatra, Borneo, India (about Seringatam), and Java. We doubt altogether the occurrence of this bird in India proper, and may remark that a Javanese female examined differed in no respect from the common Malayan peninsula race, which is identical with Dr. S. Muller's Sumatran variety.

ally prevailing; lower tail-coverts crimson, and probably the crown also of the male. Four middle tail-feathers black, the white less developed on the others than in *P. Macei*. Length probably about 8 in.; of wing  $4\frac{1}{2}$  in.; span of foot  $1\frac{3}{4}$  in.: beak from forehead  $1\frac{1}{8}$  in. Inhabits the Tenasserim provinces.

Four nearly affined species exist in *P. atratus*, *P. Macei*, *P. analis*, and *P. pectoralis*, nobis, *J. A. S.* XV, 15. The last would seem to approximate very nearly *P. analis*, Horsfield, vel *Wagnerii*, Hartlaub; but it has merely a very faint tinge of red on the lower tail-coverts.

No. 304. *P. GYMNOPHTHALMOS*, nobis. This little Woodpecker so nearly resembles *P. moluccensis* (No. 301), that the same description of the upper-parts would nearly serve for both; but the under-parts are *streakless* rufescent-white, except the lower tail-coverts which have blackish centres. The crown also differs in being of an uniform sooty-black, a little brownish towards the lores only; the outer webs of the primaries are wholly dusky-black without markings; and all the tail-feathers have series of two or three white spots along the border of each web, not developed into bands. The black generally is also more intense than in *P. moluccensis*; and there is a small naked orbital space, less developed in *P. variegatus*. We have only seen the female, but Mr. Layard informs us that the male has "a slender brilliant crimson ear-stripe."

Inhabits Ceylon; where generally observed singly upon dead trees. (Layard.)

No. 299. *P. RUBRICATUS*, nobis. The male of this was described as a particularly fine old male of *P. pygmæus* (No. 300) in *J. A. S.* XIV, 197; but we have since seen many specimens of *P. pygmæus* from the N. W. Himalaya, none of which had the crimson sincipital tuft more developed than in *P. moluccensis*; whereas of numerous examples of the present bird from Darjiling, the males had invariably this crimson much more developed, in some forming a broad occipital band completely across, and in all tending more or less to do so, the lateral portions being generally (though not always) more developed than the medial. There is no other difference, and the females are absolutely alike. The specimens which Mr. Hodgson sent from the intermediate country of Nepal were all true *P. pygmæus*, and Capt. Hutton assures us that he never saw the sincipital tuft of the N. W. race developed as in that of Sikim.



No. 305. *P. VALIDIROSTRIS*, nobis. Described and erroneously referred to *P. nanus*, Vigors, in *J. A. S.* XIV, 197; *P. nanus* being a synonyme of *P. variegatus*, Wagler (No. 303). It is probably from the Philippines or China.

No. 302. *P. CANICAPILLUS*, nobis. When I described this species in *J. A. S.* XIV, 197, I had not seen the true *P. moluccensis* which is common throughout the Malay countries, but followed Hardwicke and Gray in regarding the Indian *P. variegatus* as *P. moluccensis*. From the true *moluccensis*, *canicapillus* only differs in having the entire crown light brownish-grey, with only a little black margining the occiput; the ear-coverts are also pale brown instead of brownish-black, and the beak is chiefly or wholly whitish. These are slight distinctions, which can hardly be regarded as specific; and yet they appear to be constantly characteristic of the race from Arakan and Tenasserim, while the Malayan peninsula race is undistinguishable from that of Java.

No. 347. *CUCULUS TENUIROSTRIS*. In Lower Bengal, the majority of adults of this species have the lower-parts bright ferruginous: on the eastern side of the Bay of Bengal, all appear to be of this colour, and we have reason to infer that they grade insensibly into the smaller Malayan race (*C. flavus*) as we proceed southward, and the adults of that race we have never seen otherwise coloured. On the other hand, throughout the peninsula of India and in Ceylon, also in the Deyra Doon, the rufous-bellied specimens appear never to occur, and many are wholly dark ashy in Lower Bengal, while others from this vicinity exhibit every grade of intermediateness, having reference neither to age nor sex.

No. 386. *CENTROPUS CHLORORHYNCHOS*, nobis. Distinguished from *C. RUFIPENNIS*, Illiger (vel *philippensis*, Cuvier, No. 385), by its much shorter wings, and larger bill of an uniform greenish-yellow colour; by the darker shade bordering on marronne of the back and wings; and by the peculiar hue of the dark head, neck, and under-parts, which have a somewhat ruddy tinge, and are glossed with amethystine-purple, a redder shine of which is seen likewise to gloss the upper-parts: tail purple-black. Length about 18 in., of which the tail measures half, its outermost feathers  $9\frac{1}{2}$  in. less: wing  $6\frac{1}{2}$  in.; bill to gape  $1\frac{3}{4}$  in.; and its vertical depth fully  $\frac{3}{4}$  in.: tarse 2 in.; and long hind-claw about 1 in.

Inhabits Ceylon.

No. 405. *BATRACHOSTOMUS AFFINIS*, nobis, *J. A. S.* XVI, 1180.

In a collection made at Darjiling, among a number of supernumerary fragments we found the heads, wings, and tails of two specimens of what we now consider to be the young of this species, especially distinguished from the adult by the slenderness of the bony rami of the lower mandible, as we find to be also the case with the young of *B. auritus* (No. 403). Each is in nestling garb, though the two are remarkably unlike; one being mainly of a light chesnut hue, with nearly obsolete barred markings, and throwing out deeper chesnut or light bay feathers on the crown and shoulder of the wing; while the other is profusely mottled throughout with black on a pale ground but faintly tinged with chesnut.

*B. MONILIGER*, Layard, *n. s.* A little smaller than *B. JAVANENSIS*, (Horsfield, No. 404), which it greatly resembles at the first glance, but differs considerably in the details of its markings. Colour of the upperparts, throat and breast, bright bay or rufous-brown; the latter without spots, except a torque of white spots margined above with black above the breast, and another separating the hue of the breast from that of the abdomen; belly and lower tail-coverts contrasting pale isabelline, with similar but smaller spots, and a slight dusky mottling over the flanks: coronal feathers long, the occipital tipped with white bordered above with black, forming a white nuchal ring almost or quite continuous with the torque below: over the eye a pale rufescent supercilium; and the lengthened and erect loreal plumes are tipped with black and whitish at the extreme tip: most of the wing-coverts are tipped with a large ovoid pure white spot bordered above with black; the tertiaries are pale and delicately mottled with dusky, each having also a minute terminal black and white spot; and the primaries are black having their outer webs broadly margined with the colour of the back; the scapularies also have small terminal black and white spots, and the uppermost are pale like the tertiaries: tail mottled and obscurely banded, the bands terminating externally in series of whitish spots, successively more developed and distinct on the outer feathers. In form the tail is somewhat peculiar, its lateral halves separating into distinct lobes, whence the closed tail appears furcate. Length about 10 in., of wing  $4\frac{3}{4}$  in., and tail  $4\frac{1}{4}$  in., its outermost feather  $2\frac{1}{4}$  in. less,

penultimate 1 in. less, and ante-penultimate but  $\frac{1}{4}$  in. less. The uniform rufous-brown of the throat and breast, crossed by the white torque and bordered below by another, well distinguishes this species from *B. javanensis*; and the bright white spots on the wings (corresponding but not similar to those of the large *B. auritus*) distinguish it as readily from *B. affinis*. It remains to ascertain whether either *B. moniliger*, *B. affinis*, or *B. auritus*, presents the state of plumage corresponding to that named *Podargus cornutus* by M. Temminck, who considers this to be identical with *B. javanensis*, while Mr. G. R. Gray regards them as separate species. The dark young specimen of presumed *B. affinis* from Darjiling would seem to indicate, from its considerable resemblance to *cornutus*, that it would afterwards have assumed that dress, in which case it would seem to follow that the two are different phases of the same bird irrespective of age and perhaps sex. *B. moniliger* inhabits Ceylon, where Mr. Layard is informed that it is not uncommon at a particular altitude in the Kandyan country; and it is most probably the Coorg species seen by Mr. Jerdon, as noticed in XIV, 209.

The anatomy of this genus differs remarkably from that of *Caprimulgus*. The stomach is a highly muscular gizzard, like that of *Nyctibius*;\* and there is a large gall-bladder: sternum small, subquadrate, with but a slight keel, and four deep emarginations behind; the coracoids long and slender, and furcula like that of *Caprimulgus* but more slender. According to Mr. Gould, the outer front claw of *Podargus* is capable of reversion; but on macerating and completely relaxing the foot of *P. strigoides*, we found that it can be only half-reversed, as in *Corythaix*, *Tamatia*, and some other genera. Save in the proportional size of the feet, which are much larger in *Podargus*, there seems to be nought else to separate *Batrachostomus* from it; and it is probable that even in this respect a gradation occurs in the different species.

No. 425. CYPSELUS SUBFURCATUS, nobis: *C. affinis*, var., apud Strickland, *P. Z. S.* 1846, p. 99. Resembles *C. affinis*, but is larger, deeper-coloured, with the tail-feathers conspicuously more pointed, and the outermost measuring  $\frac{1}{4}$  in. longer than the middle ones. Wing  $5\frac{1}{4}$  in.; tail  $2\frac{1}{8}$  in. General colour much blacker than in *C. affinis*, the upper and lower tail-coverts being quite black; the white band on the

\* Gosse's 'Birds of Jamaica,' where the habits of the excessively long-winged *Nyctibii* are described as much more those of *Podargus* than of *Caprimulgus*.

rump is narrower and less purely white; and the white of the throat is also less pure. The nidification is also remarkably different: several pairs inhabiting a continuous common nest, which is affixed to an eave in the manner of that of *Hirundo urbica*, or of *Cypselus affinis*; the latter species, however, (so far as we have observed,) so placing its nest as to be concealed or at least rendered inconspicuous by a rafter or other object in front. According to the account received, a colony of *C. subfurcatus* inhabited the verandah of a house in the island of Pinang. "They began with a pair, and now compose a harmonious family of about 16 or 18. The nests are fastened to the beam much in the same way as the nest of the Swallow" (*Hirundo urbica*?), "but their nidificationary habits differ from those of the latter birds by their running two, three, or more nests into one. There were about six or eight birds in the specimen of a nest herewith sent, which had three apertures. They seem to keep a regular watch at night, for on the least noise the sentinel pipes a little and is then followed by all the rest. They lay two eggs, and are not migratory,—at least my friends are not, for they have been domiciled upwards of a year where they now are."

The nest received is a beautiful fabric in its way, remarkably light and compact; being composed of feathers and other light substances firmly bound together by a good deal of the saliva-like gluten. Several shed primaries and other feathers of the birds themselves, doubtless cast within the nest, are thus fastened in to add to the lining. The only aperture visible, now that the nest has been cut away from its place of attachment, is a somewhat prolonged entrance at one extremity; and there appear to be but two depressions adapted for the reception of eggs, which renders it probable that several of its inhabitants were the young of a former brood—or perhaps broods. The total length of the interior is 12 in., by nearly 5 in. where broadest; and this capacity would indicate that it is intended as much for a habitation for a number of the birds, as for the ordinary purpose of incubation. Procuring some nests of *C. affinis* for comparison, the size of these also indicates the fact that they are similarly inhabited; but it would appear that there is no convenience in them for more than one pair of birds to incubate. They consist of a much thicker and heavier mass of material than the nest of *C. subfurcatus*; but where two are built in contact, the wall of separation is thin, though we suspect it will be always found

intact and completely separative. During the night *C. affinis* is equally vigilant with its Malayan representative. The latter would appear to be the common house Swift of the Malayan peninsula, taking the place of *C. affinis* of India; while *C. vittatus* would seem to be exclusively a mountain species, which is common at Pinang, and which Capt. Hutton has obtained from the Tyne range of mountains near Simla; and *C. leuconyx* may be the representative of the last on the mountains of S. India.

No. 420. ACANTHYLIS LEUCOPYGIALIS, nobis. Size of *A. sylvatica*, Tickell, *J. A. S.* XV, 284; but wholly deep black with a faint gloss of blue, except the upper tail-coverts which are greyish-white and black-shafted: tail almost square, *i. e.* the barbed portion of the feathers; their spinous tips well developed, those of the middle feathers protruding  $\frac{3}{8}$  in. Length of a male  $4\frac{3}{8}$  in., by  $10\frac{3}{4}$  in. in alar expanse; wing  $4\frac{3}{4}$  in.; and tail to end of spines  $1\frac{3}{4}$  in.

From Pinang; where not a common species, two or three of them appearing now and then about the hill on the island, their rapid flight rendering them difficult to shoot like the rest of the genus. The large Malayan, Nilgiri, and Ceylon species (*A. gigantea*) was observed on the same occasion: but our informant was unable to procure a specimen from the extreme velocity of its flight, which produced a loud rustling or rushing sound through the air.

COLLOCALIA——? (No. 428, *H., Catal.*, p. 315). Several specimens of a *Collocalia* from the Navigators' Islands differ only from the Indian and Malayan *C. brevirostris*, (McClelland, v. *nidifica*, Gray), in being rather blacker, with a dingy whitish band across the rump, seen obscurely in some Indian specimens but not in others; though never so distinct or nearly so as in the Polynesian race. The latter is much too large and too dull-coloured to correspond with Mr. G. R. Gray's figure of his *C. troglodytes*, from the Malayan peninsula. That a *Collocalia* inhabits the S. Seas is, we believe, not generally known; and *C. francica*, (Gmelin), is another true species of this well marked generic form inhabiting the Mauritius, Madagascar, and probably all suitable parts of the E. Coast of Africa. Some few Indian specimens of *C. brevirostris* have the tarse more or less feathered, as in *Cypselus* (verus).

NO. 469. *CISSA PUELLA*, nobis. Size and structure of *C. VENATORIUS*, the outermost and penultimate tail-feathers shorter than in that species. Entire head, neck, and breast, with the outer webs of the primaries, secondaries, and tertiaries, bright bay or ferruginous-brown: rest of the plumage beautiful deep blue of different shades, except the tips of all the tail-feathers which are white bordered above with black, the middle pair with merely a trace of this: inner webs of the primaries and secondaries black, empurpled except on the primaries: anterior half of the wing deep indigo-blue; the back, tail except the tips, and a band across the breast, smalt blue: lower-parts dull bluish-grey. Such are the colours of what is evidently a bird in its first plumage. The beak looks as if it would probably have become deep coral-red; and the feet are pale, with dusky claws. Bill to gape  $1\frac{9}{16}$  in.; wing  $6\frac{1}{4}$  in.; middle tail-feathers 8 in., the outermost  $2\frac{3}{4}$  in., and the rest evenly graduating.

This beautiful species inhabits Ceylon.

NO. 528. *PARADOXORNIS* (*HETEROMORPHA*?) *CANICEPS*, nobis. Length about 6 in., of wing  $3\frac{1}{2}$  in., and tail 3 in., its outermost feather  $\frac{1}{2}$  in. less: bill to forehead  $\frac{1}{2}$  in.; and tarse nearly 1 in. Colour rufescent-brown above, white below; the head pure grey, with a black superciliary line commencing from the nostril, and also a black chin. Bill yellow; the legs plumbeous, with conspicuously pale claws. Intermediate in form of beak to the nearly affined divisions *Paradoxornis* and *Heteromorpha*.

Procured at Darjiling.

NO. 541. *PARUS RUFONUCHALIS*, nobis. Length  $5\frac{1}{2}$  in., of wing 3 in., and tail  $2\frac{1}{8}$  in.: bill to forehead  $\frac{1}{2}$  in., and tarse  $\frac{5}{8}$  in. Colour grey, with a fulvous tinge on the back and belly; nape-spot, axillaries, and lower tail-coverts, ferruginous: crown, throat and breast, black, the coronal feathers elongated to  $\frac{7}{8}$  in.: ear-coverts and sides of the neck pure white: bill black; and feet plumbeous.

The specimen described (a male) was procured by Capt. Hutton from the range beyond Simla, near the snow line.

NO. 659. *CARPODACUS GRANDIS*, nobis. A typical species, distinguished by its comparatively very large size. The male is fine red, as usual, but we have only the female to describe from. Length 7 in., of wing  $3\frac{1}{8}$  in., and tail  $2\frac{3}{4}$  in.; bill to gape  $\frac{5}{8}$  in., and tarse  $\frac{3}{4}$  in. Dull

hair-brown above, the feathers centred with blackish-brown; below pale, with a median dusky streak to each feather.

From the same vicinity as the last.

No. 708. *EMBERIZA ALBIDA*, nobis. Size and structure precisely as in *E. citrinella*; and colour much the same, except that the yellow is replaced by white, and the ferruginous hue seen more or less in *E. citrinella* as a line on each side of the throat and also on the breast and flanks, is much more developed on the throat, sides of the neck, and around and posterior to the eye. Length about 6 in., of wing  $3\frac{1}{2}$  in., and outermost tail-feather  $3\frac{1}{4}$  in.

From the same vicinity as the last; and the only perfectly typical Bunting we have seen from any part of India.

No. 709. *EUSPIZA SIMILLIMA*, nobis: *Emberiza melanocephala* of India, auctorum; *Tanagra rudis*, (*Mus. Carls.*), Latham,—the female? Differs from *Eu. melanocephala* (vera) in its much smaller size; the closed wing measuring  $3\frac{1}{4}$  in. instead of 4 in., and the rest in proportion. Common in S. India.

No. 712. *EU. FLAVOGULARIS*, nobis: *Emberiza aureola* of India, auctorum. Differs from *Eu. aureola* of Siberia in having no black on the chin and throat, in the well defined yellow supercilium, and in having the ear-coverts intermixed with yellow or grey. Common in the countries bordering the Bay of Bengal to the eastward, as low as the Tenasserim provinces, and also met with in Asám and along the S. E. Himalaya.

*EU. HUTTONI*, nobis: *Emberiza Buchanani* apud nos, *J. A. S. XVI*, 780.\* Nearly affined to *Eu. hortulana*, but differing in colour, having the scapularies, fore-part of wing, and margins of the coverts and tertiaries, of the same pale rufous buff as the entire under-parts from the breast inclusive, which is similar to that of the abdominal region only of *Eu. hortulana*. Head, neck, throat, and interseapularies greyish without marks, but traces of striation on the lower part of the back. Orbital feathers whitish. Bill and feet pale. Inhabits Afghanistan.

No. 727. *ACCENTOR ATROGULARIS*, Hutton. Closely affined to *A. strophiatius*, but the throat black, divided from the ear-coverts by a pale line proceeding from the corner of the lower mandible, and this with the entire supercilium and the breast, of an uniform light rufes-

\* *E. Buchanani*, nobis, = *Eu. hortulana*, (L).

cent-sandy hue. General colour brown above, the feathers centred dusky, more rufescent on the back, greyer on the nape, rump and upper tail-coverts: crown darker; a broad upper superciliary line, with the ear-coverts and throat, dusky-black: belly whitish; the flanks streaked with dusky: wing-coverts slightly tipped albescent, forming slight cross-bands. Beak dusky, yellowish-horny towards gape; and feet pale. Length about 6 in., of wing  $2\frac{7}{8}$  in., and tail  $2\frac{1}{2}$  in.; bill to gape  $\frac{9}{16}$  in., and tarse  $\frac{3}{4}$  in.

The specimen (a male) was procured by Capt. Hutton from the range beyond Simla, near the snow line. Together with *A. strophiatius*, and an undescribed black-headed species we have also seen from the N. W. Himalaya, it would seem to be nearly affined to the very rare European *A. montanellus*, which it is probable belongs properly to the high mountains of W. Asia.

No. 800. *DRYMOICA ROBUSTA*, nobis. Differs from *Dr. sylvatica* of the Nilgiris in its darker shade of colour above, and larger and stronger bill and legs, which last appear to have been of a deep reddish-brown colour: the flanks and sides of the breast are duskyish.\*

Genus *THAMNOCATAPHUS*, Tickell. Form and aspect of *Lanius*, with exactly the beak of *Laniarius*, Vieillot, but proportionally larger, and the stouter tarse of *Telephonus* but more lengthened. Wings short and much rounded, as in the former; having the 3rd to the 7th primaries even and longest. Tail moderately long and even, with the exception of the outermost feather which is a little shorter. The plumage, also, has the soft loose character of that of *Laniarius*, contrasting in this respect with *Lanius*.

No. 866. *TH. PICATUS*, Tickell. Length about 9 in., of wing  $3\frac{3}{4}$  in., and tail the same, its outermost feather but  $\frac{1}{2}$  in. shorter; bill to gape  $1\frac{1}{16}$  in.; and tarse  $1\frac{1}{4}$  in.; vertical depth of bill  $\frac{3}{8}$ , its terminal hook and notch but slightly developed. Colour dull greyish-black above, deeper on the crown, and blackest on the lores and ear-coverts: a white line on the wing, formed by the tips of the second row of coverts and continued along the margin of the two of the first row of

\* Since the catalogue was printed, we have ascertained *Dr. inornata* (No. 804) to be merely the worn and abraded plumage of *Dr. macroura*, (Franklin), vel *fusca*, (Hodgson) No. 805, and we much doubt if *Dr. Jerdoni* (No. 803) be more than an occasional variety. *Dr. inornata* is the oldest admissible name.



coverts: lower-parts uniform rufescent-white, tinged with ferruginous on the flanks and lower tail-coverts. Bill black: and the legs apparently have been plumbeous.

From the vicinity of Darjiling. Capt. Tickell refers a second species to this genus, which is *Gampsorhynchus rufulus*, nobis (No. 865), and the affinity of which to the Shrikes we immediately recognised on seeing *Th. picatus*, though not a sufficient approximation of it to the latter to warrant (as we conceive) their being arranged together in the same minimum division. *Gampsorhynchus* has a weaker and less compressed beak, the upper mandible of which is however more hooked at its extremity; and the gape is furnished with very conspicuous long and stout vibrissæ, whereas those of *Thamnocataphus* are small and inconspicuous. There are besides various other differences.

No. 1007. ERYTHROSTERNA PUSILLA, nobis. Differs from the Himalayan *E. acornaus*, (Hodgson), in having the upper tail-coverts and margins of the tail-feathers constantly of a rufous-brown colour instead of pure ashy. The dimensions assigned to *E. acornaus* in XVI, 127, are those of the present species; viz. Length  $4\frac{3}{8}$  in., by  $6\frac{3}{4}$  in. expanse; wing  $2\frac{1}{4}$  in.; tail  $1\frac{1}{2}$  in.; bill to gape  $\frac{1}{2}$  in.; tarse the same. Colour grey-brown above, with a rufescent-tawney tinge on the rump, deepening on the upper tail-coverts and margins of the rectrices; there is also a rufous tinge about the lores; lower-parts white, pure on the throat, belly and under tail-coverts, tinged with grey on the breast and flanks. The axillaries also are pure white; and the greater wing-coverts are tipped with whitish, forming a slender cross-band. Bill black; and legs dark-coloured. Sexes alike.

This little unassuming bird is common upon trees about the villages of Central India, and makes its appearance soon after quitting the alluvial soil of the Lower Ganges to the westward; but we have never met with it upon the alluvium. In habits, as in structure, it much resembles *E. leucura*, which last has all the manners of the true Robins, and certainly is not more of a Flycatcher than the common British Redstart. The name *Erythrosterna*, by no means felicitous, was applied by the Prince of Canino to the *Muscicapa parva*, auct., of S. Europe; from which our Indian *E. leucura* would seem only to differ in having the ferruginous colouring which the males assume in spring confined to the chin and throat; instead of spreading down the breast as in *Ery-*

*thaca rubecula*. *E. erythaca*, nobis, *J. A. S.* XVI, 126, is again closely affined, but well distinguished. Identical in structure, but without the white on the tail, though otherwise similar in general colouring, and also of a smaller size, we have them the Himalayan *E. acornaus*, of which we have now seen numerous specimens all quite similar; and the present little bird of Central India, which we formerly supposed to be identical with the last, until we found the distinguishing characters of each to be constant.

No. 1020. *CYORNIS MAGNIROSTRIS*, nobis. The same Darjiling collection which yielded the fragments of a *Batrachostomus* contained also the female of a species of *Cyornis* quite different from any previously examined. It resembles the female of *C. rubeculoides*, but is larger, with a proportionally larger and more robust bill, a very conspicuous ring of rufescent feathers around the eye, and very pale or whitish legs and claws. Length about 6 in., of wing 3 in., and tail  $2\frac{1}{4}$  in.; bill to gape  $\frac{7}{8}$  in.; and tarse  $\frac{3}{4}$  in. Colour brown above, darker and less tinged with tawney than the female of *C. rubeculoides*: wings and tail inclining to ferruginous: lower-parts bright ferruginous, paler on the throat, pure white on the belly and lower tail-coverts, and the flanks brown. Bill dusky. This bird is certainly neither the female of *C. unicolor*, nobis, also a Sikim species; nor that of *C. pallipes*, (Jerdon), of S. India.

No. 1065. *MUSCISAXICOLA*—? Length  $7\frac{1}{2}$  in., of wing 4 in., and tail 3 in., its outermost feather  $\frac{1}{2}$  in. less; bill to gape 1 in.; and tarse the same. Colour brown above, paler below; supercilium and throat white, the latter speckled over with dusky tips to the feathers: white centres to the pectoral feathers more or less developed: base of the secondaries and some of the primaries ferruginous, bordered with a blackish band beyond, and then again rufescent. Bill dusky, and feet brown. From Chili.

No. 1199. *HIRUNDO HYPERYTHRA*, Layard. Resembles *H. daurica*, but has the entire under-parts (inclusive of the ear-coverts) of the same deep ferruginous huc as the rump, which is deeper than that of *H. daurica*: the mesial streaks of the feathers of the lower parts being less developed. Accordingly, this species bears exactly the same relationship to *H. daurica*, which *H. cahirica* does to *H. rustica*, and has the same claim for separation.

It appears to be peculiar to the island of Ceylon, where Mr. Layard informs us that "it builds in the houses of Newera Eliya, and does not migrate." A remarkable contrast to the habits of *H. daurica*; while it curiously resembles in its stationary abode the *H. cahirica*."

No. 1834. *ALCIPPE NIGRIFRONS*, nobis. Closely affined to *A. atriceps*, (Jerdon), from which it differs in not having the whole crown black, but only the forehead continued as a line backward over each eye, and the ear-coverts. The tail also is darker, and distinctly rayed with dusky-black. General hue fulvous-brown above, and on the flanks and lower tail-coverts: rest of the under-parts pure white, the axillaries tinged with rufescent. Wing  $2\frac{1}{4}$  in.

Inhabits Ceylon.

Genus *DRYMOCATAPHUS*, nobis. Type *Brachypteryx nigrocapitata*, Eyton.

No. 1835. *DR. FUSCOCAPILLUS*, nobis. Like *Dr. nigrocapitatus*, but the supercilia, uniform with the lores, ear-coverts, sides of neck, throat, and entire under-parts, pale ferruginous-brown, a little deeper on the breast: coronal feathers dark brown margined with dusky-black, and pale-shafted: rest of the upper-parts uniform greyish olive-brown, the primaries margined paler, and the extreme tips of the tail-feathers rufescent. Bill pale, the upper mandible dusky: and feet pale. Length about  $6\frac{1}{4}$  in., the wing  $2\frac{7}{8}$  in., and tail  $2\frac{1}{2}$  in.: bill to gape  $1\frac{3}{8}$  in.; and tarse 1 in.

Inhabits Ceylon.

No. 1079. *ACROCEPHALUS DUMETORUM*, nobis: SYN. *Acr. montana* of India, auctorum. "*Calamoherpe montana* of India," writes Mr. Strickland, "is not Horsfield's *montana*, in which the wing is 2 in. long, graduated; the 5th quill longest."

No. 1836. *LEUCOCERCA COMPRESSIROSTRIS*, nobis. Like *L. albofrontata*, but with the bill much more compressed. Perhaps a variety only. From Ceylon.

No. 1219, *C. DICRURUS MACROCERCUS*, var. The Cinghalese representative of this species appears to be invariably much smaller than the race of all India, adults having the wing but 5 to  $5\frac{1}{4}$  in. (instead of 6 in.), and the rest in proportion. *D. longicaudatus* of Ceylon differs in no respect from the common Indian bird; but *D. cærulescens* of India is replaced in Ceylon by the nearly affined *D. leucopygialis*: and a very distinct species exists in the same island, the *D. edoliformis*, which is

in fact an *Edolius* without the racket tail, its tail quite resembling that of *D. macrocerus*.

No. 1248. *HYPISIPETES CONCOLOR*, nobis. Resembles *H. psaroides* and *H. nilgiriensis*; but is altogether blacker, the black of the crown forming thus no contrast with that of the rest of the upper-parts: lower-parts and rump dusky-cinereous, and slight edgings of the same to the alars and caudals: upper tail-coverts black.

Inhabits the Tenasserim provinces.

No. 1397. *PTILINOPUS*—? A beautiful species from the Navigators' Islands. Predominant hue of the male a pale canary-yellow, or yellowish-white (that of a *Mealy* Canary) with a broad band of deep lake-red crossing the back and shoulders of the wings; cap of the same lake-red, also the lower tail-coverts, and the medial portion of the pectoral feathers, which last have forked or divergent broad white tips: below, the breast is tinged with orpiment-yellow; and the lower portion of the back and edges of the tertiaries are bright yellowish-green: outer webs and tips of the secondaries and primaries deep green, the secondaries having a very narrow white margin: wing-coverts, tertiaries, and tail greyish-white, more or less margined with the yellowish-green hue of the lower back. Wing 5 in.; tail 3 in. In the female the predominant hue is deep green, a little bronzed on the wings; the tertiaries are slightly edged with yellow; the vent is yellow; crown and lower tail-coverts as in the male, lake-red, but the latter mingled with the yellow of the vent; the sides and back of the neck are tinged greyish, with an obscure dull fulvescent band in place of the bright red dorsal band of the male; and the breast is green, with white tips to the feathers. Outermost primary sinuated as usual in this genus.

No. 1400. *CARPOPHAGA IANTHINA?* *Columba ianthina* (?), Temminck. A typical species, with the base of the upper mandible tumid. Head, neck and breast uniform pale and slightly vinaceous grey, with a slight white ring surrounding the base of the bill; abdominal region pale dull vinaceous, passing to deep ferruginous on the lower tail-coverts: rest of the upper-parts deep emerald green mingled with steel-blue, which last predominates on the primaries and tail. Wing 10 in.; tail  $6\frac{1}{2}$  in. Received from Java.

No. 1402. *C. PUSILLA*, nobis. Like *C. sylvatica* (vel *ænea* of India), but much smaller, and the nape very rufescent. Length of wing  $8\frac{1}{4}$  in.; of tail  $5\frac{1}{2}$  in. Nilgiris.

No. 1407. C. (?)——? General aspect of typical *Carpophaga*, but the wings and tail comparatively very short, and the colouring much as in *Chalcophaps*. Head and throat dull vinaceous-brown, deepest on the occiput, paler about the forehead, and passing to deep bay or reddish-ferruginous on the breast, again paling and passing to dingy isabelline on the vent and lower tail-coverts: nape pure ashy: mantle and wings deep emerald-green, bronzed on the middle of the back, and passing to fine garnet-red on the upper tail-coverts: tail glossed with the same, and blackish with the terminal fourth pale grey. Length of wing  $7\frac{1}{4}$  in.; and tail  $4\frac{1}{2}$  in. This very beautiful species was obtained on an islet off the coast of Waigou.

No. 1413. PALUMBUS TORQUATUS, Asiatic or Himalayan variety. Only differs from the European race in having the neck-patch constantly of a pale buff colour instead of white, and generally much less developed, being often nearly obsolete. Common in the N. W. Himalaya.

No. 1427. GEOPELIA ALBIVENTRIS, nobis; *Columba Maugei* (?), Temminck. This species differs from *G. tranquilla* of Australia in having the barring of the breast carried much further down, and extending across the breast (which is not the case with *G. striata* of the Malay countries), and the abdomen and lower tail-coverts are pure white, without any rufescent tinge. From Timor, whence not unfrequently brought alive to Calcutta, together with *Turtur bitorquatus*, *Chalcophaps chrysochlora* (the Australian species), and numbers of *Cacatua sulphurea*. Though named *albiventris* in the Catalogue, we have now reason to suppose it to be *G. Maugei*.

Nos. 1467 to 1470. EUPLOCOMUS. There are four well marked races of *Kallij* Pheasants severally inhabiting different parts of the Himalaya, Asám, and the Burmese countries; and they seem to interbreed freely together in the wild state, producing every gradation of intermediate variety, wherever either of them comes in contact with another in the same region. This is most remarkably shewn in *Eu. lineatus* (No. 1467) of Tenasserim, &c., and *Eu. Horsfieldi* (No. 1468) of Asám and Sylhet, the intermediate Arakan race shewing every possible gradation from one to the other: and the Nipalese *Phasianus leucomelanos*, Latham, intermediately placed to *Eu. albocristatus* (No. 1470) of the N. W. Himalaya and *Eu. melanotus* (No. 1469) of the Sikim ranges, is in like manner intermediate; the male having a black

crest, and the quantity of white bordering the rump-feathers of *Eu. albocristatus* much reduced. The male *Eu. melanotus* has a thin black crest, and no trace of white on the rump, and its tail is also longer than in the others; but in other respects it is quite similar to *Eu. albocristatus* of the N. W.; and the females of all are alike, except that the hen *Eu. lineatus* has the pectoral feathers white-centred to a greater or less extent.

On the other hand, it may be remarked that a pair of hybrids raised from the male *Gallus Sonneratii* and a picked common hen engendered very freely, and many eggs were laid; but none of these would hatch, although other eggs placed with them in the same nest produced chicken, as usual; numerous other eggs were also obtained from the female hybrid trodden by a common domestic cock, and from common hens trodden by the male hybrid; but all attempts to hatch these were equally unsuccessful.\* We now expect to raise hybrids from the male *Gallus Stanleyi* (vel *Lafayettei*) and a prolific half-bred jungle-hen from Arakan, apparently the produce of a domestic hen by a wild *G. ferrugineus* (v. *bankirus*); and hope to be able to follow up the experiment as with *G. Sonneratii*. That all our diversified domestic fowls are derived from *G. ferrugineus* is indicated by the *crow* of any domestic cock and by all the *language* of the poultry-yard, which are essentially similar to the notes of the wild bird; whereas the voice, whether of *G. Sonneratii* or of *G. Stanleyi*, in every note they utter, is exceedingly dissimilar from the voice of *G. ferrugineus* wild or tame, and equally unlike one from the other. Yet the cocks recognise and acknowledge each other's widely different *crows*, and fight as eagerly together as with their own kind.†

\* Yet we have seen  $\frac{3}{4}$  bred fowls (*i. e.*  $\frac{1}{4}$  Pheasant) in the London Zoological Gardens; an intermixture in this case of different genera (as now recognised), instead of different species of the same genus.

† The *crow* of *G. Stanleyi* is a sharp dissyllabic sound, in which Cinghalese sportsmen fancy they hear the words 'John Joyce,' pronounced very sharply and in a peculiar key. (Layard.) That of *G. Sonneratii* may be imitated, but scarcely expressed in writing,—a sort of *charar-charácha*.

Here it may be remarked that a friend lately succeeded in obtaining a hybrid chick between the male *Pavo muticus* and female *P. cristatus*; but unfortunately it did not live many days, and it is now mounted in the Society's Museum.

Nos. 1510 to 1512. *ARBORICOLA*, Hodgson. There are three distinct races or species of this genus which require discrimination.

No. 1510. *A. TORQUEOLA*; *Perdix torqueola*, Valenciennes: *P. megapodia*, Temminck; *P. olivacea*, Gray. The common Himalayan species, from Simla to Darjiling; with the crown and ear-coverts of the male ferruginous, passing down the sides of the neck; lores, supercilia, and throat black, the lateral and lower feathers of the last white-margined; a broad and *defined* white torque or gorget above the breast, and sometimes (but not always) a small white streak from the base of the lower mandible. Females have the torque ferruginous, and the throat less deep ferruginous spotted with black more or less; the crown and ear-coverts dusky olive-brown, and a pale rufescent supercilium speckled with black: the black bars and spots are also more developed on the upper-parts generally; and the ferruginous torque has never a black border. This is the only race we have seen from the N. W. Himalaya; and at Darjiling we are informed that it inhabits a loftier range of elevation than the next.

No. 1511. *A. RUFUGULARIS*, nobis. Rather smaller, on the average; throat and front and sides of neck of the male deep ferruginous, with small black specks on the throat and a *black margin* to the ferruginous more or less developed, separating it from the pure ash-colour of the breast; an ill-defined white streak with black specks on each side of the throat, and similar but more rufescent supercilia. The bars on the upper-parts are generally quite obsolete. In the females these are well developed; and unless the throat may be of a deeper ferruginous, there seems to be no difference between this sex and the female of *A. torqueola*. The present race would appear to be common in the vicinity of Darjiling.

No. 1512. *A. ATROGULARIS*, nobis. Breast and flanks of the male pure ashy without any rufous, but a few small white spots on the flanks; abdominal region pure white; crown of the same olive-green as the back, passing to ashy on the forehead; supercilia black margined above with white, and lores black bordered below with a broad white streak from the base of the lower mandible; chin also white in some, but in general the chin and throat are deep black, bordered below by an *undefined* white gorget, and the upper-part of the breast has large black drops below the white gorget. The upper-parts are more dis-

tinely barred in this sex than in either of the other races; and there are no white medial streaks on the scapularies. The female is at once known by her black throat, passing into rufous with black spots below; middle of front of neck unspotted rufous; breast ashy, with a little rufous on the flanks; and the upper-parts unbarred, instead of having broad black bars as in this sex of the other races. *A. atrogularis* is common in Asám, Sylhet, and Arakan, from which provinces we have seen many dozens alive at different times, and always true to the distinctive characters here indicated. In the Tenasserim provinces, this race seems to be replaced by the affined *Rollulus (?) ocellatus*; and about Pinang the representative is *A. (?) Charltoni*, (Eyton), though *R. (?) ocellatus* likewise inhabits the same latitude in the Malayan peninsula, but we have never seen either in Malacca collections.

No. 1528. TURNIX—? A small extra-Indian species, resembling the hinder figure of Dr. A. Smith's plate of *T. lipurana* of S. Africa, except that the bill and feet are yellow, and the forehead, supercilia, cheeks, and breast are bright ferruginous, extending laterally upon the flanks, which have transverse black spots bordered with white; abdominal region white, passing to pale rufous on the lower tail-coverts. Upper-parts with alternately black and deep ferruginous narrow cross-bars, and the feathers more or less edged with yellowish-white: primaries plain brown, the three outer with a pale yellowish margin; and the coverts are speckled with small white spots on a ferruginous ground variegated with black. Bill slender. Wing  $3\frac{1}{4}$  in. Tarse  $\frac{7}{8}$  in. Habitat unknown. Probably China? Or Philippines?

No. 1659. PORPHYRIO CHLORONOTUS, nobis. Similar to *P. ALLENI* figured in Mr. G. R. Gray's 'Illustrated Genera of Birds,' but very much smaller, the wing but  $5\frac{3}{8}$  in., bill to gape  $1\frac{1}{8}$  in., and tarse 2 in. Habitat unknown. For dimensions of *P. Alleni*, vide *Ann. Mag. Nat. Hist.* X, 204.

No. 1673. RALLUS INDICUS, nobis. Resembles *R. aquaticus*, but averages a rather larger size, having the wing 5 to  $5\frac{1}{2}$  in., and the bill is constantly more robust. Of many dozens of specimens, we have never once seen the pure ashy hue of the under-parts so common in *R. aquaticus*, there being always much intermixture of brown. Common in L. Bengal, and in India generally.

No. 1764. SARCIDIORNIS (?) LEUCOPTERUS, nobis. This is a very



fine new Duck, with broader and more depressed bill than in *S. melanotus*, and no knob in the only specimen as yet examined. The tarsi also are shorter, the toes larger, and the claws much larger than in *S. melanotus*. General colour black above and below, a little glossy on the back. Head and neck white, with black feathers interspersed, forming more elongated spots than in *S. melanotus*. Anterior half of the wing white externally, followed by a black speculum; the primaries and tertiaries black, secondaries dark ash-grey, and the proximate tertiary having about half of its outer web white, longitudinally and obliquely separated, and bordered with black exteriorly. Bill yellow, with some lateral black specks, the dertrum darker; and the feet appear to have been orange. Length of wing 15 in.; of bill to gape  $2\frac{3}{4}$  in.; its uniform breadth across about  $\frac{1}{8}$  in.; tarse  $2\frac{1}{4}$  in.; and middle toe and nail  $3\frac{3}{8}$  in. From the Tenasserim provinces, where said to be not uncommon. *N. B.* Though approaching *Sarcidiornis* in plumage, and especially in its spotted head and neck, this bird should perhaps rather range nearer to *Anas* proper.

No. 1786. FULIGULA——? This Cape Pochard was described as *F. mariloides* in *J. A. S.* XII, 180, but it seems to be another closely allied species; if new, *F. obscura*, nobis.

No. 1741. PELICANUS JAVANICUS (?), Horsfield. No. 1742. P. PHILIPPENSIS, Gmelin, described *Ann. Mag. N. H.* XIV, 122. These two species of Pelican are common throughout S. E. Asia, and its islands, and we believe are here correctly identified. The first closely resembles *P. onocrotalus*, but has never the full and copious pendent occipital crest of slender feathers, about 5 in. long, which distinguishes *P. onocrotalus* at least in the breeding season; the head and neck plumage being of quite a different character, not silky and fur-like and the feathers undistinguishable apart as in *P. onocrotalus*, but open, flimsy, and downy, and curving round upward towards the occiput,—characters which are more strikingly developed in *P. philippensis*.

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*Sketch of the Recorded Revenues of the states beyond the Sutluj,  
about 1750 to 1800, by Major ANDERSON, C. B.*

At a period when so much attention is being bestowed upon the newly acquired territories of the Punjab and Peshawur, a sketch of their anciently estimated revenue may not prove devoid of interest; these, are given in totals; the amount being that demandable by the state, as the claims on the various districts; for what would now be simply denominated land revenue, in those days, the greater portion consisted in the share of the grand grain crop; though no doubt, many minor taxes and huwaluhs are also included, as the proportion of the minor or secondary crops, with shop, poll, and cattle taxes.

In the demands on the towns are also included the various excise and transit duties.

The total contains the various Jaegeers granted to state officers and servants; a mode in which a very large portion of the armies of the Government was paid; these Jaegeers might probably amount to  $\frac{4}{5}$  of the whole, leaving  $\frac{1}{5}$  for the private purse of the emperor. On the other hand these totals are not the whole extracted from the people; at least  $\frac{1}{4}$  more might be added, for local impositions, expences of collections, dues to village and district officers, &c.

The amounts were first taken from the Meezan ol Momalek of Moezallah Mohmundee, of Peeshawur; written for Wulee Khan Wuzeer to Ahmud Shah Dooranee.

The various items of Kabul and Peeshawur, within a trifle, give the stated totals; as from his position the writer must have had opportunity to correctly ascertain these amounts.

But when he proceeded to the more distant places of Lahoor and Scinde, either from original want of information, or from errors of transcription, the items and totals can in no respect be made to correspond.

Recourse has therefore been taken to the Chuhar Gulshun; and as of it, the totals correspond with the totals of the Meezan; the details also of the first work were accepted as correct and are used for Lahore, Moltan and Tutuh. The rupee in quantity of silver may be taken as equal to that of the present Company's rupee.

Whether the countries have improved, since these periods, is a question; but I should be inclined to think they have retrograded.

Kabul and all the trans-Indus states have deteriorated ; Cashmeer was ever overrated. The removal of the grand governments from Delhi as a centre, with the alterations of the lines of trade, must all have operated on those quarters distant from the sea and from the capital, hence it may be questioned if these amounts of revenue are at the present moment exceeded.

What may be effected under an enlightened Government and a continuance of peace, remains to be seen.

Revenues of the Soobuh of Kabul.

City of Kabul, .....	10,53,597	
Koh-damun.		
Ushturgram, .....	1,16,109	
Ertalef, .....	2,35,164	
Kah-duruh, .....	74,572	
Lumghan, .....	78,612	
Bulkhak,.....	78,642	
Muhood Urakee, between Ka- bul and Nugruo,.....	76,454	
Sal, Oolung, near Sirchushmuh,	33,359	6,99,567
Lhoogurd.		
Lhoogurd, .....	2,15,721	
Muedan, .....	65,525	
Huzaruh Behsood,.....	15,000	2,96,246
Guznuen, called Nawur, .....		
Guznuen, .....	76,425	
Gurdeez,.....	7,500	1,77,080
Zermol.		
Ghoorbund.		
Ghoorbund, .....	46,279	
Kahmurd, .....	61,250	
Bamean Zoohak,.....	37,500	1,45,029
Punjeer or Punjsheer.		
Punjeer, .....	30,625	
Nujruo, .....	37,500	
Budruo, .....	27,500	
Ulus, .....	15,000	1,10,625
Nungnuhar or Julalabad,.....		75,952



Districts remaining to modern Kabul, ..	32,02,338	
„ acquired to the Punjab, .....	13,79,272	
Cashmeer.		
Meraj and Kamraj, .....	25,00,000	
Kishtewar, ....	1,00,000	
Tebbut, small, .....	2,00,000	
„ large.		
Buloor containing the temple of a celebrated idol.		
Pukulee, .....	1,90,800	29,90,800
Moltan.		
Moltan, .....	31,80,683	
Debalpoor, .....	6,09,681	
Bhukur, .....	6,59,931	
Shewestan or Shewan, .....	2,90,740	
Nughurabad, or Deeruh, .....	6,25,594	53,66,530
Tutuh.		
Tutuh, .....	7,99,383	
Hajeekhan rather Chachgan, .....	2,01,737	
Chukurhaluh, .....	4,30,377	
Nusrpoor, .....	3,01,411	17,32,908
The Soobuh of Laheer.		
Buet Julundur, .....	35,94,625	
Dooabe Baree, .....	49,33,927	
„ Chunao, .....	10,66,212	
„ Jhoobut, .....	23,17,208	
„ Send Sagur, ..	35,14,996	
Dhum Mulookee, .....	3,75,518	
Kanguruh, Nugurkoot, .....	6,78,121	
Chumbuh, .....	1,15,000	
Kuhloor, capital Pulashpoor, .....	45,000	1,66,40,606
Grand Total of Trans-Sutluj India, .....		3,13,12,514

Now thus distributed.

Punjab,	English.		
Lahoor, „ .....		1,66,40,606	
Moltan, „ .....		31,80,683	
Daruhjat, „ .....		6,25,594	
Debalpoor, „ .....		6,09,681	
Acquired from Kabul, trans-Indus, ....		13,79,272	2,24,35,836

Kabul Dost Mohummud, .....		32,02,338	
Cashmeer Gulab Sing,.....		29,90,800	
Scinde	English.		
Tutuh,	„	17,32,908	
Bhukur,	„	6,59,931	
Shewan,	„	2,90,740	26,83,579
Grand Total, three crores, thirteen lacs, twelve thousand, five hundred and fourteen rupees,			3,13,12,514

*An Eighteenth Memoir on the Law of Storms in India, being the Cyclone of 12th to 14th October 1848 in the Bay of Bengal. By HENRY PIDDINGTON, President of Marine Courts.*

[Throughout this paper the word CYCLONE designates a Circular Storm.—H. P.]

PART I.

Between the dates above—stated a Cyclone of excessive violence which probably originated in the China Sea on the 7th\* *settled down* in the middle of the Bay of Bengal in about Lat. 17° 47'; Long. 88° 18'; and travelled up to the N. 41°, West to Point Palmiras. From this spot, and on this rhumb, it exactly crossed the track of both the outward and inward bound ships, and this at a busy season, so that much destruction of life, and loss of property took place amongst those who were ignorant, neglectful, or despisers of the Law of Storms; seven vessels having disappeared and fourteen being dismasted. But on the other hand, as will be seen in the Logs and in the Summary and Notes which follow them, we can now adduce numerous and striking examples in which ships have distinctly and unquestionably been saved from severe straining and damage, and in some instances probably from foundering, by the careful attention of their commanders to the precepts of the new

\* Of which I have little doubt. It may have come in from the Pacific Ocean; the term *settled down* will be subsequently explained.

science, so distinctly indeed that I shall at the close of this Memoir give a list of the whole of the vessels with a brief note to each, describing their management and what it should have been according to our rules, which every sailor can verify upon the chart with the Log before him. This may probably offend some few individuals at first, but I entreat them to recollect that it is only by pointing out their errors in judgment that we can enforce, and so to say, *justify* our science to the profession at large. They may be comforted too with the reflection that fifteen years ago, had I then commanded a ship, I should myself probably have been found in the list of the blunderers.

The Cyclone cannot be said to have been felt as a heavy gale beyond Kedgerie and Saugor. At Calcutta we had nothing but the outer and varying gusts of the storm circle on the 13th, 14th and 15th, and the Barometer was not below 29.70, but there was quite enough to enable me to announce correctly in the newspapers what had taken place in the Bay, and this was soon amply confirmed by the arrival of numerous dismasted vessels; and the lessons these afforded, as contrasted with those who could fairly claim credit for good management were, as will be seen not few nor unimportant.

Like the Cyclone which passed over Calcutta in June 1842, and which forms the subject of the seventh of these Memoirs (J. A. S. Vol. XI.) the opportunity was not one to be neglected, and I have spared no pains to collect every line of information which could be obtained, and I have much pleasure in thanking the Public Officers of the Marine Departments, Merchants, Commanders and Officers of ships, all of whom with the exception of two or three were most attentive to my requests, and some of them most zealous in procuring from the unwilling, the dilatory, or the diffident, copies of their logs and notes, or replies to what must, to many I dare say, have appeared my troublesome or useless queries. I have been however able to establish with confidence by the ample records of this Cyclone many points of high importance to the mariner in his approach to our dangerous river, so as to afford him at length a code of practical directions how to manage on their approach, and to corroborate much of which we had before rather inferential than direct evidence.

In the arrangement of this Memoir as in the former ones I have first given the various logs and notices, commencing with those from the eastern side of the Bay in the Andaman sea and on the eastern and

north-eastern coasts as far as Chittagong. These are followed by those of the inward bound vessels from Madras and Europe, and then by those of the ships which stood to sea from the Sand Heads. The logs of the Pilot and Light vessels are included in the Tabular statement. I have then in a Summary detailed the grounds on which the places of the centre are laid down, and the rates of travelling, and the Summary is followed by Remarks on the various phenomena which this Cyclone has so well exhibited, and which are so essential to advance our knowledge of their causes, and as warnings of these terrific meteors, and upon Diagram No. IV. which affords by contrast a very remarkable and important lesson. I have then given a brief review of the management of each ship and a statistic summary of the whole, which will be found of great interest. The concluding section is one of Practical deductions for the management of inward and outward ships at or nearing the Sand Heads, on the approach of a Cyclone, which I trust may be found useful to the careful mariner who has the interests of his country or of his owners at heart. I should not omit to state that this memoir was ready in September, but the arrangements of the Journal would not permit of its being then published. As however a Cyclone might have occurred in October when the practical directions would have been useful to the outward bound ships, I applied to the Secretary, Mr. Laidlay, for the permission of the Council to publish that part in the newspapers, which was most readily accorded. Numerous copies of it were distributed, and Government was also supplied with them for the use of the Pilot and other sea-going vessels in its service.

*Abridged Log of the BRIG TEAK (No. 2 on the Chart) Captain  
MCFARLANE, from Pinang to Calcutta, Civil Time.*

The *Teak* left Pinang on the 19th Sept. 1848, but only passed the Sayer Islands on the 6th Oct. On the 8th Oct. in  $11^{\circ} 20' N.$  Long.  $96.31$  East, had moderate breezes S. E. and by midnight had a strong gale and hard gusts at S. W.

*On the 29th October*, strong breezes S. S. W. to south, with squalls and rain, 8 A. M. Simp. 29.94, Bar. 30.45.

*10th Oct.*—Wind from S. b. W. to S. S. W. and south, strong breeze, hard squalls and rain, the squalls veering to S. W. very uncomfortable sea. Noon Lat.  $15^{\circ} 13' N.$ ; Long.  $93^{\circ} 48' East$ ; A. M. Simp. 29.84. Midnight in 50 fathoms water.



11th Oct.—Running throughout to the W. N. W. from 5 to 8 and 9 knots, with wind South to 6 A. M. and then S. S. E. throughout, with heavy squalls and gusts, but moderating at times before noon, when Lat. 15° 19' North; Long. 91° 26' East; Bar. 29.65. Ther. 81° A. M. 2 P. M. Bar. had fallen to 29.60.; making preparations for bad weather. Midnight strong gale and very high sea.

12th Oct.—To Noon running to the N. N. W. 6 and 8 knots. Wind S. S. E. to 3 A. M. when South and S. S. E. again at 8 A. M.; 6 A. M. furious gale, the sea a sheet of foam. At Noon Lat. 18° 9' North; Long. 90° 00' East; Bars. 8 A. M. 29.47 and 29.50; Simp. 30.20; Ther. 81° Noon Bars. 29.50 and 29.47; Simp. 30.10; Ther. 82°. P. M. Gale and sea increasing and vessel ready to broach to; hove to, wind S. S. E.; 3 P. M. blowing furiously, a deluge of rain and fearful sea; 4 P. M. wind S. E.; 6 P. M. Bars. 29.40 and 29.45; Simp. 30.05; Ther. 62°. At 8 P. M. Bar. 29.58 and 29.50; Simp. 30.16; Ther. 82°. At 10 P. M. Bars. 29.64, 29.60; Simp. 30.20; Ther. 82°. Midnight clearing a little.

13th Oct.—Lying to. To noon wind S. E. strong gale and high breaking sea, weather clearing now and then; at 6 A. M. *a bank of clouds to the N. W.* 6 A. M. Bars. 29.65 and 29.52; Simp. 30.26; Ther. 81½°. Noon 29.65 and 29.63; Simp. 30.25; Ther. 82°. Lat. 18° 37' N.; Long. 89. 17. E.; P. M. Wind as before; *very high and confused seas running in Pyramids and constantly breaking*; besides a very high sea from the S. E. another equally high from the S. W.,\* had all the appearances of what is said of the sea in and after a hurricane or Typhoon. At 7-30 P. M. finding the weather had cleared, though still blowing a hard gale in unequal gusts, borne up W. N. W. and by 8 got sail fairly set. To 6 P. M. Bars. 29.60 and 29.60; Simp. 30.25; Ther. 82°. At 10 P. M. 29.68 and 29.66; Simp. 30.30; Ther 83°. Midnight strong gale hard gusts and overcast sky, sea very confused.

14th Oct.—A. M. wind S. S. E. 4 A. M. cleared up. 8 A. M. Bars. 29.70 and 29.70; Simp. 30.30; Ther. 83°. Noon Bars. 29.65 and 29.65; Simp. 30.20; Ther. 83°; Noon Lat. Obs. 19° 18' N.; Long. Chr. 67° 51' East.

*Abridged Log of the SCHOONER JOVEN CORINNA (No. 1 on the Chart) Capt. C. S. RUNDLE from Calcutta to Moulmein. Civil Time.*

The *Joven Corinna* was at Noon 8th Oct. in Lat. 16° 16' N.; Long. 91° 23' East; with a light breeze from the East; Bar. 29.74; Simp.

\* The vessel was now, as will be seen on Diagram, No. II. just without the circle, and in that part of it where the monsoon is probably forcing its way beneath the lifted part of the Cyclone. And to this we may attribute the double sea so clearly described here. The bank of clouds was undoubtedly the body of the Cyclone.

29.14; Ther. 86°. At 6 P. M. Bar. 29.72; Simp. 29.10; Ther. 85. Wind E. N. E. to midnight; vessel standing to the S. E. with a heavy head sea.

9th Oct.—Steady E. N. E. winds; increasing at 8 A. M. with cumuli; Bar. 29.71; Simp. 29.16; Ther. 85°; heavy swell from E. S. E. made preparations for bad weather. Noon strong gales East; Lat. 14° 47'; Long. 91° 54' East; Bar. 29.65; Simp. 29.10; Ther. 85. Cumuli throughout; 8 P. M. to midnight moderate; Bar. 29.69; Simp. 29.38; Ther. 85°.

10th Oct.—4 A. M. nearly calm; by 8 steady S. S. E. winds, cloudy, Cumulo-stratus and Nimbi. Noon steady wind South; Bar. 4 A. M. 29.70; Noon 29.67; Simp. 29.10 and 29.05; Ther. 85° and 86°; Lat. 15.37; Long. 92° 29' East; 2 P. M. wind in a strong squall from arched Nimbi shifted to S. W.; by 3, it is marked W. S. W. strong gales and fierce squalls with heavy rain from arched Nimbi with a very high and irregular swell and sea on. At 6 wind S. W. At 8 Bar. 29.66; Simp. 29.12; Ther. 84°, moderating a little, but at midnight, as before. Clouds marked as dense stratus and arched Nimbi.

11th October.—A. M. wind S. S. W. fierce gale and fearful squalls, but moderating to noon when fresh winds and cloudy; 5 A. M. wind S. b. W. At 7 A. M. Bar. 29.72; Simp. 29.70; Ther. 84°. Noon Lat. Obs. 15° 21' N.; Long. 94° 26'; Bar. 29.70; Simp. 29.17; Ther 4°. P. M. wind South, 5 P. M. S. b. E.. 6 S. S. W.; towards midnight increasing again to strong gale and furious squalls at intervals. Dense strata rising S. E.

12th October.—A. M. strong squalls and rain, heavy banks of clouds constantly rising from S. S. Eastward; 7 A. M. wind S. b. W.; 9 S. S. W. Noon very unsettled but wind lighter; Lat. Acct. 15° 25' N.; Long. 94° 14' East; Bar. at 8 A. M. 29.70, at Noon the same; Simpiesometer 29.17 and 18; Ther. 62 and 63; P. M. wind S. S. W. thick gloomy weather, wind veering to S. W. occasionally and from E. to South and S. b. E. Clouds dense stratus throughout. Barometer 1 P. M. 29.63; at 5, 29.64; and at 8, 29.67. Simp. at the same hours 29.15, 29.17 at 29.22 to midnight; weather at times inclined to clear up but squalls continuing at intervals.

13th October.—By noon, Lat. Obs. 15° 50' N., Long. 93° 11' East; Bar. 29.73; Simp. 29.26; Ther. 82°.; winds variable from S. b. E. 3 or 4 points, with squalls and rain, but weather breaking up and at midnight fine.

*Abridged Extract from the Log of the SCHOONER ENIGMA, (No. 3 on the Chart,) Captain CONNEW, from Singapore to Calcutta. Civil Time.*

Noon 9th Oct. 1848, in Lat. 13° 4' N.; Long. 94° 43' East; Bar. 29.45. Steering to the N. W. b. N. with a strong S. S. W. breeze and drizzling rain. Studding-sails set; P. M. hard gales from S. S. W.

10th Oct.—A. M. moderate breeze. 5 knots, from south. At noon the *Enigma* was in Lat. Acct.  $15^{\circ} 17'$ , N.; Long.  $93^{\circ} 10'$  East, with a fresh gale marked S. S. W. at noon and south P. M. and running to the N. W. 4 P. M. wind S. S. W. 10 P. M. S. W.; strong gales, rain, and hard squalls. Bar. at noon 29.45.

11th Oct.—A. M. strong gales S. S. E. at 8, and S. E. at noon. At daylight moderate, with drizzling rain; studding-sails set. Noon increasing heavy sea throughout; Lat. Acct.  $17^{\circ} 24'$ ; Long.  $90^{\circ} 55'$ . P. M. S. E. b. E. 1.30 P. M. wind hauled to the S. E. in a tremendous squall; to midnight blowing hard and sea getting up.

12th Oct.—A. M. continued heavy squalls; vessel scudding to the N. W. b. W. Noon Lat. Obs.  $19^{\circ} 19'$ ; Long. Chr.  $90^{\circ} 28'$  E.; P. M. wind marked E. S. E.; and at midnight S. E. Strong gales. In the remarks the wind is said to be from E. S. E. to S. S. E. (i. e. up to noon of 13th.)

13th Oct.—A. M. wind about S. E.; 9 A. M. signalized to go to sea from Pilot brig; noon bore N. W. to N. E. b. N.; P. M. lying to with the wind at East; midnight E. S. E.; sunset the gale was tremendous.

14th Oct.—A. M. moderating a little. Lat. Indiff. Obs.  $21^{\circ} 12'$  in 17 fs. 6 P. M. wind south; midnight terrific gale; daylight moderating again, 8 A. M. wind S. W.; noon more moderate; Lat.  $20^{\circ} 53'$ ; P. M. ran into the Pilot station, and up to Saugor.

In a note to me Capt. Connew says: "We brought it up with us from the Sayer Islands (in Lat.  $8^{\circ} 28'$ ; Long.  $97^{\circ} 40'$ ); first in a terrific squall from the S. W. round to south, and then steady, S. S. W. to S. E. till I made the Pilot on the 13th.

At *Kyook Phyoo*, on the Arracan Coast, Lat.  $19^{\circ} 26'$ ; Long.  $93^{\circ} 34'$ , from the 9th to the 14th Oct. the Barometer Register with which I am, by the attention of the authorities at that port, regularly furnished, is as follows:—I take only that at noon, as there is nothing notable in the weather, and I give it only to show the limits of fine weather.

Date.	Bar.	Ther.	Winds.	Pressure of wind. lbs. per sq. ft.	Sky.	Remarks.
9th,	29.90	$87^{\circ}$	{ Easterly; N. b. E. to E. S. E. }	15,	Clear.	{ Light breezes and hot sultry weather.
10th,	29.89	$86^{\circ}$	E. S. E.	19, ,,	cloudy.	{ Blowing fresh and cloudy.
11th,	29.84	$81^{\circ}$	East to E.S.E.	24 ,,	,,	{ Blowing fresh with rain and squally appearance.
12th,	29.80	$83^{\circ}$	East to S.S.E.	22 ,,	,,	Ditto ditto
13th,	29.80	$84^{\circ}$	{ S.S.E.W.N.W. and N. W. }	17 ,,	clear.	Moderate and fine.
14th,	29.86	$81^{\circ}$	N,W to NN.W	14 ,,	,,	Ditto ditto

The official report from Akyab, through the Superintendent of Marine, and that in reply to a letter addressed by me to Mr. Llewelyn, Harbour Master at that port, say :—

*On the 11th October* the day previous to the new moon, the weather exhibited a wild aspect; cloudy with thunder, lightning and rain during the night, with the wind from Northward and the Eastward; during the day blowing very fresh at intervals; Barometer standing at 29.60.

H. C. Schooner *Spy's* log (at anchor in the harbour of Akyab) forwarded also by Mr. Llewelyn, says—A. M. wind E. S. E.; noon fresh squalls from the Eastward and a heavy swell; midnight moderating.

*On the 12th Oct.* weather cloudy with fresh squalls from E. S. E. Barometer at noon falling to 29.55; during the night squally with thunder, lightning and rain from the Northward and Westward.

*Spy's* log; daylight, wind E. S. E.; noon strong gales and heavy squalls; Bar. 29.65; 8 P. M. wind E. S. E. midnight, weather the same.

*13th Oct.*—Blowing fresh from Eastward and E. S. E., causing a heavy swell in the Harbour, but still had no appearance of a gale; the most remarkable feature was the immense rise of tide, which had never been known by the oldest inhabitants here to have risen to such a height; but it is a fact that the whole coast, from Cheduba to Chittagong during this time was inundated for miles in shore, as well as at this place, evidently showing that it must have been blowing from the S. W. impelling the waters to the Northward: Barometer 29.50.

*Spy's* log A. M. strong gale S. E. and cloudy; noon dark cloudy weather with heavy squalls south. Midnight moderate but squally; Bar. not observed.

*14th Oct.*—Weather still looking wilder, clouds passing with greater velocity from the Eastward, tides still very high; heavy squalls from East and E. S. E. causing a high swell in the Harbour and a very high sea on the bar, and as far as the eye could scan the horizon the weather indicated a very windy appearance, and that there could scarcely be a doubt but a gale was blowing not very far away from this port; Barometer 29.48.

*Spy's* log; wind S. E. and South with a heavy swell

*15th Oct.*—Blowing fresh at intervals, winds veering gradually to S. E.; during the middle of the day heavy squalls from S. E. inclining to the Southward with very heavy gusts of wind at intervals, accompanied with rain; 4 P. M. Barometer commenced to rise, 29.55; the wind towards sunset shifted to Southward and Westward; at daylight of the 16th, the weather resumed quite a settled appearance; Barometer 29.60.\*

\* With this report was also forwarded, copy of the log of the ship *Kirkman Finlay* from Galle to Akyab, and therefore crossing the Bay on a N. E. track, but unfortunately only one position, that of the 10th October, in Lat. 13° 59' N.; Long.

*Chittagong.*

A letter from Chittagong published in the *Calcutta Englishman* of the 30th October, says:—

“The tide at Chittagong was unusually high during the day on Friday the 13th inst., but at high water at night it rose to its utmost height, being 1 foot 7 inches higher than the usual spring tides at the Suddur Ghat. Fortunately it was a very calm night, for a very little wind would have speedily driven the water over the little bunds which protect the adjacent salt golahs, containing at present about 50 lacs of Rupees worth of salt.

“The natives say that the whole island of Kotubdea was submerged, the water being 4 or 5 feet above the river.

“I find that what I have written has not much to do with the cyclone, except as shewing that some unusual influence must have been at work in the Bay to produce the extraordinary high tides here. By the kindness of a friend I am enabled to give the fall of rain at 0 foot 11 inches on the 13th, and 0 foot 05 inches on the 14th. The same authority states that the Barometer was high throughout the two days. As far as I observed the wind, I think it blew chiefly from the South and South-East, especially on the 14th. The tides continued high on the 15th, but gradually diminished.”

*Extract from the Log of the Schooner EAGLE, Capt. DARBY, (No. 4, in the Chart,) from Calcutta to Arracan. Reduced to Civil Time.*

On Tuesday, 10th Oct. 1848, the *Eagle* was at noon in Lat. 19° 44' N.; Long. 90° 35' E.; Bar. 29.30; Ther. 84°, with a steady E. N. E. breeze and fine weather. P. M. wind easterly till midnight; at sunset smart gales E. b. N. North and East; standing to the S. Eastward.

11th Oct.—A. M. wind East and E. N. E.; daylight heavy squalls from East and N. E.; 8 A. M. wind chopped to E. S. E. Noon moderate and cloudy; Lat. 19° 6'; Long. Indiff. Obs. 91° 15' East; Bar. 29.15. P. M. moderate with a heavy sea from the East. 2 P. M. squally and weather threatening. Wind P. M. East to E. S. E. strong gales; 4 P. M. smart gales, and set storm main-sail. 6 increasing throughout the night to a heavy gale from E. S. E. with a tremendous high sea. Bar. 8 P. M. 29.15; Simp. 29.00.

90° 36' E. with a moderate Southerly gale, is given, and the copyist has most mischievously omitted the distance run, though the course and winds are set down. All that I can glean from it then is, that at noon on the 11th she was under double reefs, wind S. E.; and by 7.30 she hove to with a gale from S. E.; that she continued so during the 12th, wind always S. E., and made sail only at sunset of the 13th, reaching Akyab on the 14th.

12th.—A. M. to noon, heavy gales E. S. E.; hove too on starboard tack Lat. noon  $20^{\circ} 2' N.$ ; Long.  $90^{\circ} 30'$  East. P. M. wind E. S. E.; Bar. 29.20; and at 4 P. M. wind S. E.; 2 P. M. Bar. 29.15; 8 P. M. 29.05; at 12, 28.95. Heavy gales.

13th.—A. M. Bar. 28.90; 6 A. M. 29.05; 10, 29.20; noon 29.20, with a tendency to rise. Noon wind marked S. E. hard gale and squalls with heavy rain; noon Lat. by Acct.  $19^{\circ} 54'$ ; Long.  $89^{\circ} 12'$  P. M. wind S. E. Bar. 2 P. M. 29.20; midnight 29.25. At 11 P. M. wind S. S. E.; Vessel hove too throughout this log; midnight hard gales S. S. E.; heavy thunder and vivid lightning to the S. W.

14th.—A. M. moderating; noon wind south; Lat.  $19^{\circ} 56'$ ; Long.  $88^{\circ} 57'$ ; Bar. 29.25 and rising.

*Abridged Log of the Barque ARARAT, Capt. ROUSE, (No. 5 on the Chart) from Penang to Calcutta. Reduced to Civil Time.*

10th Oct.— $15^{\circ} 41'$ , 92.45, squally, wind S. S. W. studding-sails set.

11th Oct.—Noon in  $17^{\circ} 20'$ ; Long.  $91^{\circ} 37'$ ; Bar. 29.80. Fresh breeze S. E. and cloudy; running 8 knots to the N. W. but at 3 P. M. Bar. 29.60. Cloudy, and ship preparing for bad weather, sea getting up and gale increasing; 5.30 under close reefs.

12th Oct.—6 A. M. wind E. b. N.; 10 E. N. E. Noon N. E. Increasing gale; 11 saw a ship standing to the S. E. Noon Lat. Obs.  $19^{\circ} 11'$  East; Long.  $89^{\circ} 6'$ ; Bar. 29.50; P. M. strong gale N. E. b. E.; sea getting up, 4 P. M. Bar. 29.45; 10 P. M. very hard gale, Bar. 29.30; midnight cut away the starboard quarter boat.

13th Oct.—6 A. M. wind E. S. E.; gale terrific. Noon Lat. Acct.  $19^{\circ} 31'$  N., Long.  $88^{\circ} 6'$ ; Bar. 29.00\* P. M. wind N. E.; 2 P. M. Bar. 29.40; 3 P. M. Bar. 29.00; cut away starboard boat; 4 P. M. Bar. 28.6; moderate. Breeze dying away; Bar. 28.70; every thing looking for a "gale or hurricane;" 6.45 P. M. most terrific squall from S. W., sea in a moment very high and the squalls more and more powerful; 8.30 main top sail blew away; Bar. rising to 29.10. Midnight hard gale.

During the calm, or whilst the Barometer was at its lowest point, the ship was surrounded with birds, butterflies, horseflies and all descriptions of flying creatures; one snipe was caught.

14th October.—Daylight more moderate. In 45 fs. water. Noon Lat. Obs.  $19^{\circ} 32' N.$ ; Long.  $86^{\circ} 44'$  East; Bar. 29.55. Wind W. S. W.

\* An error in copying, we might at first suppose being an oscillation from 29.30 at 10 P. M. 12th to 29.00 at noon, and 29.40 at 2 P. M.; but see *first* the log of the Barham.

*Abridged Log of the Schooner FLORA MACDONALD, Capt. MURCH,  
(No. 6 on the Chart) from Calcutta to Arracan. Civil Time.*

10th Oct.—Light breezes E. N. E. and cloudy. Noon Lat. 20° 34' N.; Long. 92° 15' East; p. m. calm and cloudy weather, current setting N. W. 2½ knots; came too in 10-fs. water off St. Martiu's Island; 9 p. m. wind from E. N. E. and sea getting up. Midnight increasing strong gales and cloudy, with a heavy high sea.

11th Oct.—A. m. wind E. S. E. increasing to strong gale and heavy sea at noon when Lat. 19°56' N.; Long. 92°0' East by Acct.; p. m. wind S. E., heavy gales and rain with squalls and gusts at times to midnight.

12th Oct.—Wind E. S. E. strong gales; Lat. noon 19° 47' N.; Long. 91°10' East; p. m. wind S. E. b. E.; weather the same to midnight.

13th Oct.—Wind S. E. strong gales and squalls. Noon Lat. 20°20' N.; Long. 90°30' E. by Acct.; vessel under bare poles; 4 p. m. wind South and S. S. E.; midnight weather the same.

*Abridged Extract from the Log of the Ship BARHAM, Capt. GIMBLETT,  
(commanded by her Chief Officer, Mr. VAILE,\*) (No. 7 on the  
Chart) from Madras to Calcutta. Civil Time.*

Oct. 10th, 1848.—Noon Lat. 15° 40'; Long. Chr. 86°15'; Bar. 29.72; Simpiesometer 29.45; Ther. 84°; p. m. fresh but unsteady breeze northerly, and squally with a heavy swell from the eastward. At 8 hard squalls and heavy sea; making preparations for bad weather; 11 *more moderate*. Midnight Bar. 29.65; Simp. 29.36.

11th Oct.—A. m. very hard squalls W. N.W. and heavy rain with vivid lighting; 2 A. m. Bar. 29.58; Simp. 29.28. Reduced sails to close-reefed topsails, the clouds having a red appearance, similar to what is observed at sunset; 7 A. m. glass rising† and weather moderating. Noon variable with passing squalls and a confused swell; Lat. Obs. 15°22' N.; Long. 87°16'. Course S. 73° East, 63'; Bar. 29.68; Simp. 29.38; Ther. 84; p. m. wind S. Westerly light airs and calms, with squally appearance all round; 3.30; breeze from the S. W.; out 2 reefs; 4 p. m. W. N. Westerly, a strong unsteady breeze with a high sea and much lightning at midnight.

Oct. 12th.—A. m. unsteady breeze N. W. and squally: *lightning has a very peculiar appearance similar to the flash of a gun*. Barometers rising and falling in a most extraordinary manner these last two days; daylight weather

\* In consequence of a severe accident Captain Gimblett was obliged to remain at Madras. It will be seen that the ship could not have been confided to abler hands.

† The Barometer tide no doubt, but the treacherous moderating as well as the red sky is well worth notice.

moderate and cloudy; Bar. 29.71. Out 2nd reefs. A number of birds flew on board, Snipes, Ringdoves, &c.; 2 A. M. strong breeze with thick weather and much rain; Noon Barometer falling to 29.40; Simpiesometer 29.12; weather very thick with hard squalls and constant heavy rain. Noon hove to under main try-sail and main stay-sail on larboard tack. Lat.  $16^{\circ} 51'$ ; Long. D. R.  $88^{\circ} 23'$ ; P. M. wind W. N. Westerly; weather very threatening, blowing a heavy gale with very hard squalls; 3 P. M. Bar. 29.27; Simp. 29.08; down top gallant yards and masts; 4 P. M. Bar. 29.20; 5, blowing very hard. Ship not moving ahead, but making as far as could be judged, about 3 knots bodily to leeward; 5 P. M. wind veering to West and W. S. W.; 7 P. M. gale still increasing, squalls very heavy. In trysail; under bare poles; the squalls blowing a perfect hurricane; midnight wind S. S. W. Bar. 29.36.

Oct. 13th.—A. M. Blowing very hard, squalls heavier, very high sea; a perfect hurricane; 4 A. M. Bar. 29.48; 5, rather more moderate but still blowing very heavy. At 6 wind S. S. E. Noon fresh gale and hard squalls, Lat. Obs.  $17^{\circ} 52'$  N.; Long.  $89^{\circ} 14'$ ; Bar. 29.58; Simp. 29.30; Ther.  $82^{\circ}$ ; P. M. wind S. S. E.; 5.15 more moderate and fine; bore up north; midnight strong unsteady breeze with hard squalls and much vivid forked lightning.

Oct. 14th.—A. M. wind S. S. E. Increasing again to a gale; hove to again after making  $84'$  to the north; 6 h. 45 A. M. Bar. 29.65. Bore up again; Noon Lat.  $19^{\circ} 43'$  N.; Long.  $88^{\circ} 44'$  East; Bar. 29.70; Simp. 29.40; Ther.  $84\frac{1}{2}$ ; 4 P. M. weather again thick; hove too again.

Oct. 15th.—Wind S. W.; 11 A. M. Ran into the light vessel. Signal to stand to sea; passed many disabled ships. On 16th got the Pilot.

By the attention of Capt. Vaile, I am enabled to add to the capital log of the *Barham*, and to the valuable lesson in Cyclonology which it affords, his remarks upon the signs of the approaching Cyclone so well observed and so carefully recorded in it.

The first of these is the *red sky*, a phenomenon well known in the Mauritius hurricanes and in the China Sea\* Tyfoons, but which was not yet known in those of the Bay of Bengal, or perhaps does not often occur. In this case too we have the singular, and for scientific purposes, very valuable peculiarity that it occurred at night! viz. from two to four A. M. and at a time when the moon was shining as brightly as it could for the clouds; it being the day before the full moon, when she had at that time an altitude of 40 or 50 degrees.

Capt. Vaile states that at this time the whole sky was clouded with dense heavy looking clouds, more of which were opposite to, than on the

\* See Sailor's Horn Book where all that is known of this phenomenon is stated.



side of the moon. The red colour extended over all, but was in patches deeper in some parts than in others, and that some clouds facing the moon were of a deep orange red, and that occurring at night it was the more particularly remarked.

The lightning of the 12th he compares both to the flashes of a gun, and, at times, to sparks as if from a flint and steel. Altogether a most remarkable kind of lightning. Very little lightning during the strength of the Cyclone—not more than three or four times altogether.

The vibration of the Barometer and Simpiometer was noticed for about two days, on one occasion it amounted to 0.4 (four tenths) in three hours. At 7 A. M. on this day they shook out reefs, for the Bar. had risen to 29.65; and at noon it was again at 29.20, and then rose again before finally falling!

*Abstract Log of the Ship WELLESLEY, Capt. F. ARROW, (No. 8 on the Chart) from Madras to Calcutta. Civil Time.*

10th October, 1848.—In Lat. 13° 40' N.; Long. 83° 45' E.; at noon breeze N. N. W.

11th Oct.—In Lat. 15° 15' N.; Long. 86° 8' East; at noon breeze N. W. to W. b. N. with dark lurid appearance to the Eastward, getting more dense, and a hot stifling feeling; towards noon clouds flying in dark rugged masses to the westward; upper strata in ridges from the East, sun obscure with red glare on the horizon to W. and S. W. looking like sunset in the middle of the day; shortened sail to prevent nearing it.\* Afternoon arched squalls from the N. E. rose, with vivid lightning; 7 P. M. looking finer; made sail.

12th Oct.—Lat. 16° 20' N.; Long. 87° 00' E.; Bar. 29.60, Simp. 29.08; Ther. 83°; looking very threatening from the northward at daylight and all the lurid appearance of yesterday; double reefed and reefed the courses; wind West; gusty and increasing with sheets of rain at times. 3 P. M. wind West; still more threatening and increasing to a gale; furling every thing and *hove to* under main staysail and trysail. 8 P. M. sent top gallant yards down; blowing a heavy gale from the westward with torrents of rain; 8 P. M. Bar. 29.50; Simp. 29.00; vivid lightning and peals of thunder all round and close over the ship, the rain was the most tremendous I ever saw, and the squalls most furious. Midnight wind commenced veering to S. W.

13th Oct.—Lat. 16° 53' N.; Long. 88° 2' E.; 7 A. M. wind S. W. to S. S. W. bore up E. N. E. to get clear of the Cyclone; under close reefed topsails and reefed foresail; heavy confused sea from all quarters since midnight. Noon wind

\* The Cyclone of which Capt. Arrow was fully aware.

shifting to southward and more moderate and finer weather; bore up my course; weather getting finer but still coming up from the southward in hard squalls.

14th Oct.—Lat.  $19^{\circ} 07' N.$ ; Long.  $88^{\circ} 57' E.$ ; gradually clearing up to a strong southerly breeze, but dark cloudy weather; at 10 P. M. hove to; not liking to approach the Sandheads till the weather cleared; midnight Lat.  $20^{\circ}$ ; strong gale increasing again from the southward, made sail and worked off. I suppose being hove to, the tail of the breeze picked us up again.

15th Oct.—Moderating from the southward.

To some enquiries made by me, Capt. Arrow says:—

“The lurid appearance which is mentioned is that of a deep leaden sky during the day time. There was also to the northward a heavy red glare.

For two days after leaving Madras a remarkable halo round the moon was noticed. It was of considerable brilliancy, and the orange and blue colours very distinct.

The arched squalls were remarkably regular in their formation, resembling those of the Straits of Malacca.

The thunder and lightning were most violent and intense from 8 P. M. 12th to 2 A. M. 13th.

Hot and cold blasts were distinctly felt. I can compare the hot blasts only to the Scirocco of the Mediterranean.

We found a very confused sea after bearing up, evidently where we crossed the track of the Cyclone.”

*Abridged Log and Notes from Capt. HUMPHRIES, Ship SEA PARK (No. 9 in the Chart) from London to Calcutta; reduced to Civil Time.*

From the line to  $14^{\circ} N.$  we had strong westerly breezes with much rain and gloomy weather, with a steady Barometer and very warm weather.

On Wednesday, October 11th.—Lat.  $16^{\circ} 57' N.$ ; Long.  $90^{\circ} 02' East$ ; Bar. at 10 A. M.  $29^{\circ} 70'$ ; Simpiesometer 29.30; winds variable from S. S. W., S. E. and Easterly, with fine weather. P. M. light Easterly breeze, veering to N. E.; 5 P. M. Bar.  $29^{\circ} 60'$ ; Simp. 29.20. At 6 P. M. in 3rd reefs; wind light and variable from N. E. and N. W. through the night. “At sunset a red lurid light in the heavens, but not of such a character as I have remarked off the Cape previous to violent gales, and in fact there was no indication for worse weather except that of the Barometer and Simpiesometer.

12th Oct.—Lat.  $17^{\circ} 54'$ ; Long.  $89^{\circ} 06' East$ ; Bar. 10 A. M. 29.35; light rains and calms; *Barometer and Simpiesometer falling at the time when the*

daily rise should take place. It continued to fall slowly but steadily. Making all preparations for bad weather. Ship covered with land and sea birds and insects which came on board for shelter and would hardly move when in danger of being trodden on. Faint variable airs till about 2h. 30' p. m. when a southerly breeze sprung up, which soon began to blow hard with a most threatening appearance. At 4 p. m. hove too in about Lat.  $18^{\circ} 6' N.$ ; Long.  $89^{\circ} 25' East$ , on the larboard tack. 6.30 p. m. Bar. 29.15; Simp. 28.80. Wind increasing fast at south, and from 8.30 to 10.30 blowing a perfect hurricane but without veering. At 8.30, when the wind was beginning to blow with the greatest fury, the Bar. and Simp. began to rise, and continued to rise steadily. Midnight Bar. 29.30; Simp. 28.95. Wind S. S. E., a hard gale and heavy gusts of wind and rain.

13th Oct.—Daylight wind S. E. very hard gale but Bar. and Simp. continue to rise; noon Lat. Acct.  $18^{\circ} 20' N.$ ; Long. Chr.  $89^{\circ} 26' E.$ ; Bar. 29.63; Simp. 29.35. Saw much wreck in the forenoon; p. m. wind S. b. E. steady southerly gale throughout; gale evidently broken; Bar. and Simp. always rising.

14th Oct.—10 a. m. Bar. 29.75; Simp. 29.32; noon Lat.  $19^{\circ} 25' N.$ ; Long.  $89^{\circ} 05' East$ . A Northerly set of 80' since the time the ship hove too on the 12th.

*Extract from the Log of the Barque ASIATIC, Capt. G. BARLOW,  
(No. 10, on the Chart) from Madras to Calcutta. Civil Time.*

On the 10th October, the *Asiatic* was at 6 p. m. in 55 fs. Lat. at noon  $19^{\circ} 41' N.$ ;  $87^{\circ} 7'$ .

11th Oct.—A. m. light variable breezes, apparently from the N. N. W. and East; ship standing to the N. E. and S. S. E.; sounded in 15 fs.; at 5, 25 fs. noon squally from the North, standing to the East; Lat.  $20^{\circ} 7'$ ; Long.  $86.56'$  East. At 8 p. m. increasing; Bar. 29.60.

12th Oct.—A. m. increasing; close reefs at noon, when wind from the N. E. Lat.  $19^{\circ} 32'$ ; Long.  $88^{\circ} 19' East$ .

4 p. m. Bar.	29.40	9h.	29.26.
5 .....	.38	10..	.14.
7 .....	.33	11..	.10.
8 .....	.33	12.,	28.94.

Midnight wind East, heavy gales but with breaks in the sky at intervals.

13th Oct.—A. m. wind East, hard gales; 7 a. m. E. N. E.; noon Lat.  $19^{\circ} 8'$ ; Long.  $86^{\circ} 8' East$ . 1. 30 a. m. wore and kept away North; at 3 a. m. hove too under bare poles. Noon hurricane from E. N. E.

1—2 a. m. Bar.	28.97	1 —6 p. m. Bar.	28.70.
3—4 .....	.90	—8 .....	.60.

—5 .....	.96	—9 .....	.90.
6—9 .....	29.00	10—11 .....	29.00.
Noon, .....	28.86	12 midnight, ..	29.20.

4 P. M. wind North ; at 6 N. b. W. ; 8 N. W. ; 10 to midnight, West ; at 8 blowing a hurricane ; impossible to look to windward. Moderating at midnight.

14th Oct.—A. M. wind S. W. ; 4 A. M. S. S. E. ; 6 South to noon, when Lat.  $19^{\circ} 50' N.$  ; Long.  $86^{\circ} 51' East.$  Fresh gales.

Bar. 1—2 A. M. 29.40. 8 . . . . 29.50. Noon, 29.70.

The Ship *Lady Sale*, Captain Castor, though not experiencing any part of the Cyclone, followed it closely up the bay, and taking her to have been on the 12th about a degree from the Wellesley to the Southward—for I have not been able to obtain her position—it shews that either the monsoon was following up the Cyclone, or that its influence extended further to the South, her Bar. register alone could settle this. The following note is sent to me by Capt. Castor :—

“ October, 1848.—Lat.  $13^{\circ} 05'$  to  $18^{\circ} 2' N.$  ; Long.  $80^{\circ} 30' W.$  ; S.  $5^{\circ} 07' E.$

From the ninth to the tenth October, while in the Madras roads, the weather was very unsettled, blowing in squalls from N. to N. E. with incessant rain for about 48 hours ; dark and gloomy appearance to the N. E. and N.

The “ *Lady Sale* ” left Madras on the 11th with fine weather, winds from the Westward ; on the 12th and 13th experienced very squally weather from S. W. to W. ; on the 13th, being farther to the North, it blew stronger from the Westward, with puffs and an irregular swell from N. E. to E., so much so that the vessel pitched her jibboom and flying jibboom away, and was obliged to ease her by reducing sail ; winds stronger from the Westward. On the 14th very fine weather with thick huge clouds over the tops of the hills on the coast ; anchored on the evening of the 14th, and found the surf very low, the tides uncommonly high, weather clear and pleasant, and continued so for some days.

(Signed) JOHN CASTOR,  
*Lady Sale.*”

*Abridged Log of the Ship BRITISH SOVEREIGN, Capt. HARRIS,*  
(No. 20 on the Chart) from London to Calcutta. Civil Time.

12th Oct.—The ship *British Sovereign* ran up from  $7^{\circ}$  North in one continued series of squalls and rain, with the exception of about 3h. from 8 to 11 P. M. of the 11th October ; wind throughout from W. S. W. to W. N. W. On the night of the 11th the stars had an unusually brilliant appearance, and the heavens were illuminated occasionally with a very red glow.

12th Oct. A. M.—Wind variable from North to W. N. W. with heavy squalls of wind at intervals. At 4 A. M. heavy squalls from the northward, rising with heavy black clouds. At 6, increasing to a steady heavy gale at west, with thick dark weather and incessant rain; making all preparations. Bar. at 1 A. M. 29.60; at 2, 29.59; at 3, 29.57; at 4, 29.55; at 5, 29.52; at 6, 29.50; at 9, 29.50; and at noon 29.50. 10 A. M. wind W. b. S.; noon W. S. W. Lat. Acct.  $16^{\circ} 37'$ ; Long. Acct.  $38^{\circ} 38'$  E.; wind very steady; set the reefed foresail. Course steered, North. P. M. wind W. S. W. No rain but thick dark cloudy weather and blowing a steady heavy gale. 6 P. M. gale increasing with violent squalls of wind and rain. At 8 P. M. in Lat.  $17^{\circ} 17'$  N.; Long.  $88^{\circ} 35'$  East, by Acct. finding the Barometer rapidly falling, squalls rapidly increasing in strength and the weather shewing every appearance of becoming worse, hove to at 9; wind S. W. b. W.; squalls terrific; at 10, worse, with vivid flashes of lightning and heavy thunder, apparently very close. Midnight blowing furiously; wind S. W. with a continuation of heavy thunder and lightning. Barometer at 1 P. M. 29.50; at 4, 29.45; at 6, 29.40; at 7, 29.38; at 8, 29.33; at 9, 29.30; at 10, 29.27; at 11, 29.25; and at midnight 29.20. Capt. Harris considers that he had the heaviest weather from 10 to 11 P. M.

13th Oct.—A. M. wind South; 3 A. M. S. b. E.; at 4, S. S. E.; at 6, S. E.; at 8, S. S. E.; and at 11, South. From 1 to 4 A. M. a heavy gale with rapid gusts of wind, sea rising fast. At 4, gusts decreasing in strength to a hard gale but with a high confused sea; by 8, wind rapidly abating. Noon moderate Lat. by Acct. (and nearly correct)  $17^{\circ} 38'$  N.; Long.  $88^{\circ} 33'$ . Bar. at 1 A. M. 29.20; at 2, 29.17; at 3, 29.10; at 4, 29.20; at 5, 29.22; at 6, 29.22; at 7, 29.30; at 8, 29.35; at 10, 29.36; and at noon 29.40.

I have placed this ship in the chart as her run and drift are given, but Capt. Harris states that he had no solar observations for two days previous to the 12th, and in such weather star observations cannot be much depended upon. She was, I have no doubt, farther to the Eastward than she supposes on the 12th, probably about half way between the positions of the *Barham* and *Sea Park*, which would then give her the winds she experienced as the Cyclone moved on and lifted up to make way for the monsoon below it. (See summary.) The Cyclone track also may have curved to the westward at first, for it seems certain that the tornadoes move in waving or oscillating lines, though the average is a straight track, and from analogy we may suppose the Cyclones to do the same.

*Abridged Log of the Barque CHARLES KERR, Capt. H. T. APPLETON, (No. 21 on the Chart) from Mauritius bound to Calcutta, reduced to Civil Time.*

12th October, 1848.—Midnight 11th—12th moderate Northerly breeze and clear. Black Pagoda N. W. b. W. distant 3 miles. At 2 A. M. increasing breeze, ship standing E. N. E.; 4, dark gloomy weather; 8 A. M. wind N. E. to noon; by 10 A. M. fresh gale and showers of rain; noon hard gales, heavy squalls and rain and confused sea; Lat. by Acct.  $19^{\circ} 36'$ ; Long.  $87^{\circ} 52'$ ; Bar. 29.60; Simp. 29.30; Ther.  $82^{\circ}$ . P. M. hard gales N. N. E.; making all snug; 8 P. M. the same; midnight wind North; Bar. 29.50; Simp. 29.20; Ther.  $80^{\circ}$ .

13th Oct.—Gale increasing to noon when heavy; veering by 10 A. M. to W. N. W. pumps choked by sand ballast, and kept ship before the wind to 9 A. M. Had made since noon 12th, 32 miles due South; noon dense atmosphere, torrents of rain and sleet;\* all hands bailing; Lat. Acct.  $19^{\circ} 02'$ ; Long.  $87^{\circ} 27'$ ; Bar. 28.90; Simp. 28.70; Ther.  $79^{\circ}$ . P. M. wind S. W. b. S. 2 P. M. glasses began to rise. 7 P. M. wind South. 8 P. M. Bar. 29.20; Simp. 29.10. Heavy gale throughout; ship running to N. N. E. and N. E. 6 and 7 knots. Lost main-topmast and mizen topmast, at midnight more moderate.

14th Oct.—A. M. wind South. 5 A. M. S. S. W. to noon; by 10 A. M. fresh breeze; Lat. noon  $20^{\circ} 14' N.$ ; Long.  $88^{\circ} 42'$ . Bar. 29.60; Simp. 29.40; Ther.  $83^{\circ}$ . After which made the Pilot.

Capt. Kerr's private note book, kindly placed in my hands, says, after describing the veering of wind. "Throughout there was a dense atmosphere and torrents of rain and sleet when blowing from the N. W. The Bar. and Simp. gave timely notice, but nothing was remarkable in the sky prior to its commencement, with the exception of an unusual bright appearance and twinkling of the stars on the night of the 12th. The Bar. 28.9; and Simp. 28.7 at noon on the 13th, when at its height, and a few hours afterwards, they began to rise. On the night of the 13th,† a very heavy swell was setting in from the Eastward, which broke very high on the beach near the Black Pagoda. The sea very luminous and occasionally some thin white clouds passed rapidly over the moon from the N. Eastward.

\* This sleet was, Capt. Appleton informs me true sleet, i. e. rain and snow with small hailstones, while the wind was between N. and W. When it hauled to the Southward it ceased.

† So in MSS.; 11th and 12th meant.

*Abridged Log of the ship SIR ROBERT SEPPINGS, Captain STUART, (No. 22 on the Chart), from Columbo to Calcutta, reduced to Civil Time.*

October 10th, 1848.—At noon light airs and hot sultry weather, Ganjam bearing N. W. dist. 20 miles; Lat. Obs.  $19^{\circ} 15'$  North; Bar. 30.9; Ther.  $90^{\circ}$ . P. M. light variable winds, standing to the Eastward. Midnight wind N. W. *Memorandum.* This ship had been on the 6th in sight of Juggernath Pagoda, but had been set down the coast by the baffling winds and the Southerly current.

Oct. 11th.—To noon standing to the Eastward with a fresh Northerly and N. N. Easterly breeze and a heavy head sea. At noon Lat.  $18^{\circ} 55'$  North; Long.  $86^{\circ} 18'$  East; a current setting to the S. S. W. 2 miles per hour. Bar. 29.90; Ther.  $89^{\circ}$ . P. M. fresh breeze with a heavy head sea; standing to the Eastward  $2\frac{1}{2}$  to 4 knots, with variable northerly breezes. 8 P. M. squally and rain, with a dark threatening appearance; ship pitching very heavily. Midnight strong breezes from the Northward; much lightning to the Eastward.

12th Oct.—3 A. M. *more moderate.* At 8 strong breezes Northerly, with a very threatening appearance; increasing at noon with hard squalls, when Lat. Acct.  $19^{\circ} 27'$  N.; Long.  $87^{\circ} 20'$  East. Standing to the Eastward; Bar. 29.70; Ther.  $86^{\circ}$ . P. M. Wind North strong gales, heavy squalls and rain;  $5\frac{1}{2}$  P. M. making all preparations for bad weather; down Royal yards and close reefing. 8 P. M. Bar. 29.55; gale increasing with a very threatening appearance; hove too under main trysail. Midnight hard gales and heavy rain; Bar. 29.50.

13th Oct.—At 2 A. M. *more moderate and Barometer rising.* Set reefed foresail and main topsail; at 4 again hove to, gale increasing and Barometer falling to 29.20. To noon wind always East, to N. E. at noon, when Lat. by Acct.  $19^{\circ} 40'$  N.; Long. Acct.  $88^{\circ} 00'$ ; P. M. wind marked N. E., hard gales. 2 P. M. more moderate, set foresail and main topsail again; wind S. E. Bar. 29.40; 4 hard squalls and heavy rain, Bar. falling to 29.10; at 5 P. M. wind marked S. S. E. 6 P. M. weather more threatening, took in foresail and main topsail, both of which blew to pieces. The furled sails now blowing from the yards; wind S. E. to South. 7 P. M. wind S. S. W., ship on her beam ends, main and mizen masts and foretopmast went by the board. 8 P. M. wind South; pumps choked, crew baling; midnight a continuation of heavy gales, wind veering from S. E. to S. S. W. Position during the height of the hurricane was about  $19.30$  N.  $87.35$  East.

14th Oct.—1 A. M. wind S. S. W.; 4 A. M. South; 9 A. M. S. b. E. to noon; 4 A. M. the same weather; at 8 more moderate to noon, when Lat. Obs.  $19^{\circ} 45'$  N.; Long.  $87^{\circ} 50'$  East; Bar. 29.1; Ther.  $79^{\circ}$ . P. M. wind S. S. W. Moderating to midnight, when wind S. b. W.—noon Lat.  $19^{\circ} 45'$ ; Long.  $87^{\circ} 50'$ ; Barometer broken in the height of the tempest.

To the foregoing, which is partly from the ship's log and partly from a note obligingly sent me by Capt. Stuart, he adds:—

“I must observe that for several days previous to the hurricane the weather assumed throughout the day a very unusual appearance, with light baffling winds and hot sultry weather. Ther. from  $86^{\circ}$  to  $92^{\circ}$ ; a misty horizon and at night a misty circle round the moon and an unusual twinkling of the stars. An immense number of both sea and land birds were constantly about the ship, with much lightning from the Eastward and South Eastward at times.

*Abstract from the Log of the ship CAMPERDOWN (No. 12 on the Chart), Captain CUMBERLAND, from London to Calcutta. Civil Time.*

At noon on the 10th October, 1848, the Floating light bore N. E. b. N. 50 miles, Lat. Obs.  $20^{\circ} 17' N.$ ; by 6 o'clock we had run about 25 miles, on a N. E. course, when we saw a vessel, which we supposed to be a Pilot Brig, as she was running down to a ship at anchor, bearing N. E. from us dist. about 8 miles; at this time it had fallen calm and we found there was a strong current running to the S. W. but, as the water was too deep for the bower, let go the kedge and veered a hawser, which only checked, but did not stop her from driving. Soon after (about 7 P. M.) a light breeze sprung up; weighed the kedge and stood N. W. a few miles, but finding the wind falling light and the ship refusing to steer with a 5 knot breeze, again let go the kedge and veered 2 hawsers; the ship still driving; the current appeared to be running about 3 knots.

*Wednesday, 11th October.*—A light breeze springing up, weighed the kedge and stood to the N. East about 15 miles, but at 4 tacked, as she broke off to N. b. E., and knowing the current was running very strong, I was afraid of being driven to leeward, intended to stand well to the Southward to get out of the strong current. 6 A. M. Lat. by Sirius  $20^{\circ} 51'$ , stood S. E. all the day; at daylight saw a steamer steering to the Southward; noon squally and rain, Lat. Obs.  $20^{\circ} 32' N.$  There was no appearance of bad weather this day; P. M. cross sea. 3 P. M. in 1st reefs; there were a few light showers, but the clouds had little motion.

*Thursday, 12th Oct.*—Tacked and stood to the northward; saw a Pilot brig at anchor and a ship. At 11, the brig signalled us to stand to sea till the weather moderated. At this time the weather was not bad, but the Barometer had begun to fall, 29.60; noon Pilot vessel N. N. E.  $15'$ . Tacked and stood S. E. In 3rd reefs. At 11 P. M. hard squalls.

*Friday, 13th Oct.*—Weather looking bad, close reefed the main topsail; at 3 A. M. Bar. 29.20. Prepared for a gale: blowing very hard during the day



from E. N. E. to East. At noon wind at S. East; Bar. 29.00. At 5 P. M. Bar. 28.90. At 6, 28.70. At 7, 28.50; secured the sails before dark; furled the main topsail, and prepared for a hurricane, manned the pumps, and got life lines along the deck. From 7h. to 7.30 P. M. a lull, but the Bar. was still inclined to fall. Expected a shift to the Southward and more wind; *at this particular time, the weather was fine overhead*; 7.30 hurricane from the W. S. W. About 8, the wind drew gradually round to South and S. S. W. and by  $\frac{1}{2}$  past 8 the wind was blowing a perfect hurricane, with hard rain, the wind not blowing steadily, but in gusts; expected the masts to go over the side every moment; got axes all ready to cut away, sent the carpenter down in the well and ascertained that the ship was perfectly tight, it being of course impossible to sound the pumps with any degree of accuracy, owing to the quantity of water taken in to leeward; at this time the lee hammock nettings were washed away, the lee quarter boat, and the main and mizen royal masts; the foretop gallant mast was fortunately housed, but we had not time to house the others; had the foretop gallantmast been up we should certainly have lost the foretopmast. The Barometer at midnight 28.50, began to rise soon after the shift, and continued to rise through the greatest strength of the gale. I think the hurricane did not last in its greatest strength more than 2 or 3 hours, but of that I cannot be certain.

*Saturday, 14th October.*—At 1 A. M. Bar. 29° 00'; not so much wind, but still blowing a heavy gale from S. S. W. At daylight found ourselves in 17 fathoms. False Point N. W. 7 miles. Set the foresail and wore to the Eastward. At noon a fresh gale, Bar. rising 29.40.

*Sunday, 15th Oct.*—Unsettled weather, blowing fresh from the Southward; at 6 P. M. saw the Pilot Brig at anchor off the South Buoy, passed under his stern, told us he had not got any pilots, and sent us to sea again; stood to the S. East all night from this time; had light baffling winds till Tuesday 17th. At 8 P. M. got up to the light vessel, and received a Pilot on board. The last 2 or 3 days saw many vessels totally dismasted; boarded the Collingwood, totally dismasted, and offered any assistance in our power.

*Abridged Log of the Ship COLINGWOOD, Capt. MOLISON (No. 13 on the Chart,) from England to Calcutta with troops on board—reduced to Civil Time. The force of the wind marked by the Admiralty numbers.*

*On the 11th October, 1848, at Noon, the Colingwood was in Lat. 16° 21 N.; Long. 88° 38' East, standing to the N. W. with fine weather, a four and five knot breeze from the N. Eastward; Bar. at noon 29.67; Ther. 83°. P. M. cloudy and passing showers—wind variable from the Northward, West and N. East, to midnight.*

12th October.—Winds variable from the N. Westward, with cloudy weather and squally at times ; ship standing 5 and 6 knots to the N. N. E. and N. E. At noon Lat. by Acct.  $17^{\circ} 46' N.$  ; Long.  $89^{\circ} 6' East$  ; Bar. 29.37. P. M. A ship in sight to the N. N. W. standing S. E. under close reefed topsails, with top gallant masts down. 3 P. M. Bar. 29.25, and falling fast since noon ; made preparations for bad weather. P. M. wind variable from N. Wd. ; at 4, Westerly ; 5, S. Westerly ; at 7, S. b. E., at 8 S. S. E. and at 10 S. E. b. S., force increasing from 4 to 9 to midnight ; ship running to the N. E. b. N., North and N. N. W. from 4 to 10 knots. Midnight Lat. by Acct.  $18^{\circ} 55'$  ; Long  $88^{\circ} 44' E.$  High sea getting up ; Bar. 29.25.

13th October.—3 A. M. Bar. 29.30 ; at 8h 30'. 29.40. Set foresail ; at 11 h. Bar. 29.45 ; wind S. E. b. S. to 6, when E. S. E. ; at 8 East and at noon E. S. E. force 8. Lat. Obs.  $20^{\circ} 27' N.$  ;\* Long. about 87.35, according to Capt. Molison, Bar. noon 29.50 ; Ther.  $82^{\circ}$ . P. M. Moderate gale (force 8) E. b. N. cloudy, gloomy, hazy and constant rain ; 1 h. 36. in 35 fs. water off Cape Palmiras 4 P. M. Bar. 29.40, at 6, 29.20 ; wind E. N. E. (9). Gale increasing ; 7.30, a perfect hurricane, with thick hard rain ; Bar. 29.00 ; wind E. S. E. (11—12). At 8 Bar. 21.80. Soon after 7. 30. P. M. lost bowsprit and foremast and main and mizen topmasts, quarter boats, &c. At 10 wind veering to S. E. (10) at 12 Southerly (11—12) Bar. 29.05, hurricane raging with the utmost fury.

14th Oct.—3 A. M. wind S. S. W. ; 4 Bar. 29.30, hurricane moderating ; 5. 30 A. M. saw False Point Light house S. W. ; sounded in 7 fathoms water. At 6 came too in 5 f. False Point Light S. b. W. To noon gale decreasing from S. b. W.

*Abstract from the Log of the ship EDMUNDSBURY, Capt. REDPATH, (No. 14 on the Chart,) from Ceylon bound to Calcutta—reduced to Civil Time.*

I am indebted to Mr. Thos. Scallan of the Pilot service, for some notes corrective of this ship's log, arising from errors of the copyist, or from the confusion incident to vessels on their beam ends with their ballast shifted, in a hurricane. It was probably filled up from recollection, and contained some evident oversights.

\* The true position is about  $18^{\circ} 40'$  ; Long.  $88^{\circ} 44'$ . The Log is very carefully marked, but it gives 31' more of northing than the observation of the following day, which I take to be owing to the southerly current off Point Palmiras, arising from the curving of the Easterly set over the Sand Heads, as will be shewn in the remarks. The current was probably much heavier, for the ship had, no doubt, the storm current and perhaps a little of the storm wave in her favour.

The *Edmundsbury* at noon on the 11th October had received her Pilot on board in the course of the morning, and had at noon the outer Floating Light bearing E. b. S. 10 miles; winds variable from E. S. E. and squally. 2 P. M. came too in 5 fs. 3.45, commenced weighing, and at 6.30 stood to sea with a strong breeze at E. N. E. 8 P. M. increasing; midnight, Bar. 29.65.

12th Oct.—4 A. M. increasing and threatening appearance, making all preparations; noon Bar. 29.60. Fresh gale, strong squalls and heavy appearance to the Eastward, wind varying from N. E. to East. P. M. Lat. by double Alt.  $19^{\circ} 53'$ ; Long.  $88^{\circ} 11'$  East; Bar. 29.60. Increasing strong gales E. N. E. and at 5 P. M. East to N. E.; 8 P. M. Bar. 29.58; 10 P. M. 29.56; midnight 29.50. Blowing a hard gale.

13th Oct.—A. M. wind N. E.; 4 A. M. increasing, with threatening appearances; at 8 A. M. made every thing snug for bad weather. Noon hard gale and dark cloudy weather; Bar. 4 A. M. 29.40; 8h. 29.30; noon 29.20; Lat. Acct.  $19^{\circ} 21'$ ; Long.  $87^{\circ} 49'$  E. P. M. hurricane at N. E., ship under bare poles. 4 P. M. more moderate. 5 P. M. dead calm, tremendous cross sea; Barometer falling fast, 28.90. Drizzling rain with threatening appearance to the N. W.; heavy bank rising fast to the South. Trimmed ballast which had shifted. 6.30 P. M. commenced blowing from the N. W. and veering to the Westward; at 8, blew a hurricane; Bar. 28.40; ship lying on her beam-ends and refusing to wear. Winds at 5 P. M. marked N. W.; at 7 P. M. W. b. N. and at midnight a furious hurricane S. W. lulling a little; all hands by the axes for cutting away.

1h. P. M. Bar. 29.18.	7h. P. M. Bar. 28.60.
2 ..... .00.	8 ..... .65.
3 ..... 28.90.	9 ..... .75.
4 ..... .80.	10 ..... .80.
5 ..... 28.60.	11 ..... .86.
6 ..... 28.40.	12 ..... .98.

14th Oct.—2 A. M. lulling a little; Bar. rising fast, wind S. W. Bar. 28.90. By 4 A. M. wind had veered to S. S. W.† half past 4 wore and stood to the E. N. E. At daylight saw the *Framjee Cowasjee*; passed her at 7 A. M. in Lat.  $19^{\circ} 45'$  N.; Long.  $86^{\circ} 38'$  East. Noon a large ship to the N. W. b. W. with foremast, bowsprit and stump of mizen mast standing. Another to the S. S. E. with her foremast and topmasts gone, both dist. abt. 5 miles Noon Lat. Obs.  $20^{\circ} 2'$ ; Long.  $87^{\circ} 7'$  East. Winds marked, 5 P. M. S. S. W; 7, South; and at 11, South.

\* Pilot's note S. W.

1h. A. M. Bar. 29.00.	7h. A. M. Bar. 29.50.
2 ..... .14.	8 ..... .60.
3 ..... .20.	9 ..... .60.
4 ..... .30.	10 ..... .60.
5 ..... .35.	11 ..... .60.
6 ..... .40.	12 ... .. .60.

P. M. by midnight had run into 27 fs. with fresh gales and cloudy weather from S. S. E. and at 3.30 A. M. of the 15th, saw the light vessel's signals again.

Capt. Redpath adds in reply to my queries, that on Tuesday 10th, at sunrise, he remarked a dull lead coloured sky to the S. E. but it cleared away by 8 A. M. of that day. He experienced no lightning at any time during the Cyclone. When at the calm centre it was much lighter overhead; the appearance like the breaking up of a heavy gale, but after one hour a dark heavy bank formed to the N. W. in the form of an arch. The ship was surrounded by birds of various kinds and amongst the rest they caught a parrot; swallows, gulls, boobies, &c.; all quite exhausted.

After the Cyclone a dull heavy appearance to the N. W.

*Abridged Log of the ship FRAMJEE COWASJEE, Capt. EDWARDS, (No. 15 on the Chart,) from England to Calcutta—reduced to Civil Time.*

The *Framjee Cowasjee* had received a Pilot on board on the 11th October, at 7h. 30' A. M. At noon the floating light bore East and the South Channel Buoy S. S. W. P. M. wind E. N. E.; wind light from E. N. E. Midnight light breeze, rain; out 2d reefs topsails.

12th Oct.—6 A. M. to noon heavy squalls working to the Eastward; Bar, 29.46; Lat. by Acc. abt.  $20^{\circ} 18'$ ; Long.  $88^{\circ} 27'$  East;  $2\frac{1}{2}$  miles per hour of westerly set being allowed. P. M. to midnight increasing gale from E. b. N. Ship standing to S. E. b. S. and at 9.31 P. M. hove too,

13th Oct.—Heavy gale E. N. E.; noon Bar. 29.44. P. M. wind marked E. b. N. high sea and tremendous gusts increasing to a hurricane. 5 P. M. moderating to a gale with vivid lightning to the westward; at 6, wind *hauling* to the Northward and round to the S. W. braced round on the starboard tack with head to the Eastward; wind W. S. W.; at 8, lulling to a calm with a very high sea. Calm lasting till 9 P. M., when it commenced to blow and increased to a fearful hurricane. Midnight still increasing, Bar. 8 P. M. 28.52; at 11, 28.72; at midnight 28.90.

\* So in Log, but evidently an error, and that 28.44 is meant.

14th Oct.—A. M. blowing a violent hurricane from S. W. 5 A. M. lost main and mizen masts. Barometer 1.30; A. M. 29.10; at 2h. 30' 29.22; at daylight was passed by the *Edmundsbury* in Lat. 19° 45' N.; Long. 86° 38' East. Noon moderating and fine with a very high sea; 8h. wind strong; at 2 P. M. saved five hands from about 47 of the crew of the *Hope* which had foundered; her crew had constructed rafts which the *Rustomjee* could not succour as she was unmanageable.

#### FALSE POINT PALMIRAS.

*From MR. BARCKLEY, the Superintendent of False Point Light-house, I have the following memorandum taken down verbally from his information.*

Gale commenced on the 12th with heavy squalls N. E. to N. W.; between 12th and 13th blowing N. N. E. and always increasing; began to blow steadily on to 13th from the N. E. and on the night of that day very heavy.

A shift took place to N. N. W. at about 9½ P. M. of the 13th with high water. Then it fell a dead calm at 10, which lasted to 12½ or 0.½ A. M. the rain clearing off: saw the stars very clear over head, but a thick bank of haze all round. At 12½ breeze fresh and very stormy from S. S. E. to a complete hurricane, which lasted about seven hours, varying only two or three points more to the Southward.

The rise of tide, which was about 9 ft. more than usual\* (entire rise 17 ft. high) came in with a rush like the bore. I saw it come in a heavy foaming surge of a wave like the surf outside of Plowden's Island; † I heard it coming in and went up to see what it was; and from the gallery of the Light House saw it distinctly. I at first thought it was the Island being washed away. This bore came in about two o'clock in the morning ‡ when the hurricane had reached its full height from the Southward. It was a bright moonlight night, clear over head and cloudy almost in a circle towards the horizon. During the whole time it was blowing there was no lightning, but during the calm there was some forked lightning, mostly from the Northward and Westward,

\* In this estimate Mr. Bond, Master Attendant of Balasore agrees.

† At the entrance of the mouth of the Mahanuddy on the North shore, on which the Light House stands.

‡ When the tide therefore was at three quarters ebb.

It began from the N. Westward. The natives never knew such a rise of tide before. At Puttamundy and Hall and Sunkse, to the North and Eastward, the tide rose 19 or 20 ft. in all, or about 11 ft. above its usual height. These places are on the North side of False Bay; about 6 or 700 natives were drowned: all their huts destroyed and cattle drowned. Water remaining for about three days, all the while the wind was to the S. E. not falling more than 4 ft. and it was only when it veered to the Westward that it went down very rapidly."

It would appear from this very valuable note that the centre passed over the False Point Light House on the night of the 13th, at 11 P. M. In stating the date from which the track is laid down, and in the observations, I shall advert at length to the evidence we have here of the storm wave.

## BALASORE.

From this station I have the following report, through the Superintendent of Marine, by A. Bond, Esq. the Master Attendant there.

Report of Weather at Balasore, 10th to 15th October, 1848.

Month.	Date.	Mean Bar.	Bar. per hour.	Ther. Mean.	Remarks.
October.	10th	29.72.	29. { .74. .72. .70.	84°.	{ S. E. to N. W. with rain, cloudy.
"	11th	29.68.	{ .72. .68. .64.	83½.	{ S. E. to N. W. lightning à S. E. Eastward and West; rain from S. E. with heavy clouds.
"	12th	29.64.	{ .66. .65. .61.	82½.	{ N. W. breeze, very cloudy and rain à N. E. with heavy gusts of wind.
"	13th	29.60.	{ .63. .60. .57.	82.	{ Wind shifting à E. N. E. to E. S. E. with heavy rain; another tier of clouds above travelling from S. W.
"	14th	29.49.	{ .53. .48. .47.	81.	{ Rise of water at the Tide Gauge 21 feet, being 8 ft. above spring tides. Wind E. N. E. at 6 P. M.
"	15th	29.68.	{ .60. .69. .75.	81.	{ Shifting to East and E. S. E. at high water ½ past 9 wind increasing in stronger gusts with

Wind S. W. and fair,

heavy rain till 1 A. M. of the 15th October, when the wind gradually veered round from S. E. to South, and cleared up at S. W. with passing showers; Barometer 29.60 at 8 A. M.

*Remarks.*

On the 14th instant it appeared clearer at intervals through the clouds to the Westward, as if inclined to break up, and from the deposition of a servant who was at False Bay at the time, he says "the wind was from the N. E. on the 11th with heavy rain, and the wind blew in very heavy gusts. On the 12th wind  $\hat{a}$  S. E. with strong gusts and heavy continual rain. The 13th, the wind from S. E. blowing a hurricane till 2 P. M. of the 14th instant, when it cleared up with wind at S. W., and it is reported that the sea broke into the villages near False Bay, and that numbers of lives have been lost. The Arab ship "*Abassee*" went on shore on the 14th instant at False Bay, dragging her anchors from 9 fathoms, more from the very heavy sea running than from the wind, which on the 14th had abated.

The gale seems to have increased as it extended to the S. W., as the damage is by far the greatest to the S. W.

A. BOND,  
*Master Attendant.*

*Balasure, M. A. Office, the 25th October, 1848.*

*Abstract of the Log of the American ship WASHINGTON ALSTON, Capt. DAY, (No. 16 on the Chart,) outward bound; reduced to Civil Time.*

11th Oct. 1848.—The *Washington Alston*, at 11 A. M. on the 10th Oct. had the light vessel bearing N. E. b. E. 10 or 11 miles, and A. M. on the 11th to noon stood to the S. S. W. and S. S. E. and S. E. b. S. with light Easterly baffling breezes till noon when in Lat.  $20^{\circ} 15' N.$ ; Long. by account about  $88^{\circ} 36'$  East. P. M. squally rain, and large sea; midnight more moderate. Ship standing to the S. S. E. and S. E. and S. b. E. Wind is marked E. N. E. but I take it to have been from E. N. E. to E. S. E. by the courses. I allow also 1 mile per hour of current to the Westward for the average of the set over the Sandheads.

12th Oct.—A. M. squally. Noon hard squalls and heavy sea, no observation; wind E. N. E. Lat. by account  $19^{\circ} 02'$ ; Long.  $88^{\circ} 46'$  East; taking in second reefs, and reducing sail; shipping much water. P. M. heavy gales, wind E. N. E. 5 P. M. East. 5.30 hove too. 10 P. M. S. E. Midnight very heavy gales.

13th Oct.—A. M. heavy gales, ship all under water; 1.30, ship full of water fore and aft, hove deck load over board. Before noon foremast and head of the mainmast went, nothing standing but the mizen mast and broken main mast, and the mate and a man overboard. Wind at 6 A. M. S. S. E. and at noon South, after which not marked; estimated position when dismasted Lat.  $19.44$ , Long.  $88.03$  East; allowing  $60'$  of drift to the N. W.

14th Oct.—Morning gale abated. No position given at noon P. M. wind marked S. W. blowing hard all night.

15th Oct.—Noon Lat.  $19^{\circ} 52' N.$ ; after which fine weather.

It was the 19th November before this disabled ship could get in far enough to get a Steamer !

*Abridged Notes from the Log of the Schooner JOHN HEPBURN, Captain PLUM, (No. 17 on the Chart) from Calcutta bound to Penang. Civil Time.*

The Schooner *John Hepburn*, left the Pilot on the 7th October, in the evening, and had light variable winds to—

*Tuesday, October 10th, 1848.*—A. M. wind light and variable from East to E. N. E. steering to the S. Eastward. Noon Lat. Obs.  $19^{\circ} 28' N.$ ; Long. Chr.  $88^{\circ} 33' E.$ ; Barometer 29.67; Ther.  $87^{\circ}$ . P. M. moderate light breeze and fine; sunset weather becoming unsettled, clouds rising up from the Eastward, at times squally; and a swell from the South Eastward. Midnight same weather, vessel pitching heavily and taking in much water forward.

*Wednesday, Oct. 11th,*—A. M. squally W. Noon light winds, squally from E. N. Eastward; Lat. Obs.  $18^{\circ} 18' N.$ ; Long. Chr.  $89^{\circ} 6' E.$ ; Barometer 29.61; Ther.  $86^{\circ}$ . P. M. cloudy threatening weather, winds light and variable from E. N. E. to S. E.; and a *heavy swell from S. E.*; Barometer 29.50. Sunset, steady breezes and cloudy weather; midnight, swell heavy from S. E. and dark cloudy weather.

*Thursday, Oct. 12th,*—A. M. wind light and variable from N. Eastward and a *very threatening appearance to the S. W.*, standing close hauled to the S. E. to Eastward; Barometer 29.38. Daylight a ship to the S. Westward under storm sail, standing to the Northward, distance about  $1\frac{1}{2}$  miles. At 7 Bar. 29.30; Ther.  $82^{\circ}$ . Heavy clouds to the Eastward and a *dense black appearance to the S. Westward*. At 9, light winds from S. Eastward; vessel on starboard tack; heading up N. E. to E. N. E. a heavy swell from S. Eastward. Noon moderate winds and squally weather with rain; Lat. Acct.  $17^{\circ} 35' N.$ ; Long. Acct.  $89^{\circ} 36' E.$  Barometer 29.25.

P. M. wind increasing and a very high sea; Barometer falling fast, 29.20. At 2.30 strong gales and a tremendous high sea; wind S. E.; hove too under balance reefed, mainsail and a small fore staysail. At 4, gale increasing considerably; vessel lurching heavily and shipping great quantities of water over all, and to leeward, unable to look to windward for rain and spray, which blew along with great violence. At 5, shipped a very heavy sea abaft the main rigging, which filled the decks and tore away the balance reef of mainsail, &c. got a small staysail up to the mainmast to keep her too. At 6, blowing extremely hard, especially in the squalls. Barometer 29.15; vessel's lee rail and part of the deck under water. At 9, Barometer 29.9, and weather very bad, blowing a perfect hurricane. At 10, the new inner staysail blew out of the bolt ropes—all hands at the pumps. Midnight ditto weather, vessel's head N. E. to E. N. E.



*Friday, October 13th*.—A. M. bad weather. At 2, moderating a little and Barometer on the rise, but still blowing a very heavy gale and seas breaking over the vessel in all directions; pumps constantly going. Daylight Barometer up to 29.50; and a very high irregular sea, wind veering to the Southward. Noon strong winds and a high confused sea; Lat. Acct.  $18^{\circ} 15' N.$ ; Long.  $89^{\circ} 46' E.$ ; Barometer 29.59.

P. M. ditto weather; wind Southerly, after which it became fine. By observation on the 14th in Lat.  $19^{\circ} 31' N.$ ; Long.  $90^{\circ} 31' East$ ; having experienced a strong current to the North during the Cyclone, and Captain Plum adds that there was neither thunder nor lightning, while it lasted, with him.

*Abridged Log of the Barque EASURAIN, Capt. SHIRE (No. 18 on the Chart), from Calcutta to Bushire; reduced to Civil Time.*

*Tuesday 10th Oct.*—Pilot left at 2 A. M. Noon lower floating height bore E.  $\frac{1}{4}$  N. in 8 fs. water; Bar. 29.62; Lat.  $21^{\circ} 6' N.$ ; Long.  $86^{\circ} 6'$ . Light airs S. E. and fine clear weather. Midnight fresh breezes about E. b. S. and fine clear weather.

*11th Oct.*—At 3. A. M. wind E. b. S.; at 7, N. N. E.; a 4 knot breeze; from daylight to noon squalls and rain. Ship standing to the S. S. W.; Lat. Acct.  $19^{\circ} 36'$ ; Long.  $87^{\circ} 38'$ . P. M. wind North and at 9, N. E.; 5. to 4 knots. Cloudy, squally, and rainy weather. P. M. course S. W. b. S.

*12th Oct.*—At 2 A. M. wind N. W. freshening gale; at 8 A. M. wind W. b. N. 5 to 7 knot breeze. Noon Lat.  $17^{\circ} 05' North$ ; Long.  $86^{\circ} 06' East$ . P. M. moderating wind N. W. b. W. and N. N. W.; 6 to 2 knots. At 8, light airs.

*Abridged Report of Mr. T. BELL, Mate Pilot, B. P. S. in charge of the Arab ship Forth. Civil Time.*

*On the 13th Oct.*—At noon saw the outer floating light bearing S. b. W. ship standing to sea with a fresh breeze E. b. N. and beginning to feel the strong set to the westward; passed about 1 mile to leeward of the Floating Light and was signalized to stand to sea. Shortly after he estimates to be making a W. S. W. course though steering S. b. W. At sunset spoke the *Camperdown* and told her to stand to sea, but could not board her. Towards midnight gale increased, wind about N. E., running with it on the quarter (or about South) blowing furiously, all sails, furled or set, blown from the yards.

*14th Oct.*—All hands continually at the pumps to keep the water down to 3 or 4 feet in the hold. All we could do was to scud dead before it. Vessel steering remarkably well, daylight wind N. N. E.; during the day blowing furiously. 2 P. M. a little lighter and shifted to N. b. W. At 5 P. M. we had the strength of the hurricane from about N. b. W. Carried away fore and mizen topmasts. Pilot steering himself to prevent her broaching too. Hove overboard

guns and every thing on deck ; till midnight, wind and sea dreadful from N. W. to W. N. W.

15th Oct.—Breeze gradually moderate towards daylight. At noon by Observation in Lat.  $19^{\circ} 58'$  N. ; Longitude not remembered. Pilot station bearing about N. N. E.

*Ship FUTTAY ALUM bound to Calcutta. Abstract of her log forwarded by Mr. HAGGARD of the H. C. P. S.*

This log is unfortunately only an abstract and I am unable to calculate from it the ship's position on the different days of the Cyclone. I can therefore give but a brief summary of it without placing the track on the chart.

It is stated only in reference to her position that she was "on the day before the hurricane in Lat.  $17^{\circ} 58'$  North ; Long.  $86^{\circ} 34'$  East, by Chr. steering to the N. E. b. N. and N. East. I take this to have been at noon of the 11th, though the wind is marked on that day as at N. b. E.  $\frac{1}{2}$  E. to N.  $\frac{1}{2}$  E. Bar. 29.60 ; so that the ship could only have been making about an E. N. E. course at the most.

On the 12th Oct.—4 A. M. Bar. 29.56 ; at 7 A. M. 29.50 ; strong breezes N. N. E. Noon reefed foresail and making other preparations. 1 P. M. wind was N. N. E. ; Bar. 29.48 ; and by 5 P. M. N. W. and Bar. 29.46 ; weather very thick with hard rain. 11.30 hove too. Midnight wind south, blowing hard, lost a cutter, Bar. 29.40.

13th Oct.—Daylight wind S. E. ; Bar. 29.34. Heavy gales. 11 A. M. Bar. 29.30 ; hurricane ; lost topmasts Bar. 29.26 ; wind S. E. Noon furious hurricane S. E. Bar. 29.22. P. M. the same awful appearance in the weather, wind S. E. Bar. 29.22. Lost gig and mizenmast. Midnight wind S. E. Bar. 29.26.

14th.—Daylight increasing. 6 A. M. wind S. E. Bar. 29.38 ; noon 29.44. P. M. wind S. S. E. Bar. 29.44.

From this time the gale moderated, but the vessel on the 14th drifted into  $6\frac{1}{2}$  fs. 23' to the E. N. E. of the floating light, and was obliged to anchor, being a perfect wreck. One ship, perhaps the *Hope*, passed her about noon of the 13th with a signal of distress, and another the *Exmouth* foundered at her anchors in sight of her on the night of the 15th,—16th.

*Abridged Log of the Ship FUTTLE ROZACK, Capt. ANDREWS (No. 19 on the Chart), from Calcutta to Judda. Civil Time.*

The ship *Futtle Rozack* left Calcutta very deeply laden but, as will be seen, by the able and scientific management of her commander

in crossing in front of the Cyclone, she sustained no injury except the loss of an old Jolly Boat. Several of the dismasted and foundered vessels left their pilots exactly at the same time, but they seem all to have kept their wind as long as possible, and thus to have just stood into the fatal centre. To this they were no doubt led by the dread of the lee shores of Point Palmiras with an Easterly gale. I trust we shall now be able to offer suggestions, if not to lay down rules, to obviate or diminish the chances of such fatal errors in future.

*11th October.*—P. M. Lower floating light E. b. S. dirty gloomy appearance, afraid of getting a breeze about the Sandheads stood South. Wind East, 4 to 6 knot breeze, to midnight; 5 P. M. weather looking much worse, a deep red glare thrown out by the setting sun. Every appearance for a hurricane; made all preparations. At 8 increasing, at 10 a dark heavy leaden bank of clouds, but appears stationary all round, about  $20^{\circ}$  high. Above it a thin strata of clouds flying with great rapidity from the Northward. Midnight squally with rain Bar. 1 P. M. 29.70; Ther  $84^{\circ}$ ; at 8, 29.70; at 10, 29.65. Force of wind from 5 increasing to 8.

*12th Oct.*—1 A. M. Bar. 29.62; 6 A. M. 29.62; 10 A. M. 29.61; noon 29.61. From midnight very threatening looking weather, wind varying in a strange way from E. N. E. to E. S. E. to 3 A. M. moon and stars about the Zenith beautifully bright, not so much as a circle round the moon, and scarcely any scud was flying during the time the wind was flying about in such an extraordinary way. No doubt now, at 3, that this is a Cyclone; shortened sail to heave to, to allow it to pass, but wind shifting suddenly to N. N. E. kept away before it to get to the S. W. At 10 A. M. heavy-looking, dark purple or red clouds to the S. E. about  $5^{\circ}$  above the horizon, but about the Zenith some occasional light breaks. At 11.15, a sudden lessening of the wind, Barometer fell between 11h. and 12h. only .01. At noon in Lat.  $19^{\circ} 18'$ , mean D. R. and observation; Long. D. R.  $87^{\circ} 45'$ ; a tremendous sea getting up. P. M. dark, fearful-looking weather all round. Course S. W. wind N. N. E. (7), at 4 North (8), at 8 (9), at 9 (10), at 10 N. b. W. and at midnight N. N. W. (11.) At 1 P. M. the dark gloomy weather spoken of in the morning to the S. E. has cleared away, and that is now the only place with a break in it, and there the weather looks quite fine; 9 P. M. scudding under the foresail; thick lurid clouds now all round, except about the Zenith where a circle of about  $15^{\circ}$  in diameter is beautifully clear, but the scud flying past with very great rapidity from the North. Much light summer-looking lightning, only more broad and not so quick, from S. E. to West. At midnight terrific weather, the wind howling like ten thousand large plug holes with the wind blowing through them, and a very bright, but not altogether red appearance to

the East; Bar. at 1 P. M. 29.59; at 3, 29.57; at 5, 29.55; at 6, 29.50; at 9, 29.47; at midnight 29.45; ship running S. W. to 3 P. M., then South, 5 to 7 knots, to midnight.

13th October.—Blowing fearfully from N. N. W. (11) with torrents of rain more like hail, but we cannot say if it was so, the atmosphere appears closed in as dark as possible although moonlight; 3 A. M. wind N. W. b. N. (10), 6 A. M. N. W. (7), N. W. b. W. (8), 9 W. N. W. (8) and at 11 W. b. N. (8). At 4 if possible much worse weather in the squalls, lost a Jolly boat. By 8 less wind but so fearful a sea that we cannot haul the ship to the wind yet. Noon more moderate, but the same sea, ship running to the South and S. E. Noon Lat., by Acct.  $17^{\circ} 17'$ ; Long.  $88^{\circ} 5'$ . The Barometer as follows; 1 A. M. 29.48; at 2 to 4 29.42, 29.37, 29.40; at 5, 29.45; at 6, 29.50; at 7, 29.51; at 8, 29.52; at 9, 29.55; at 10, 29.56; at 11, 29.57; and at noon 29.57. P. M. moderating, made a little sail, a dark heavy leaden bank of clouds away to the N. b. W.; a cross confused sea lifting the ship up and then letting her fall as if it would jerk the masts out of her. To midnight wind from West to S. W. and S. W. b. S.; at 10 P. M. heavy squalls with dreadful thunder and lightning. At midnight moderating fast.

On the 14th Oct.—The weather became fair. Noon Lat. Obs.  $17^{\circ} 15'$ ; Long.  $88^{\circ} 26'$ .

On the 18th.—Picked up the Rustomjee Cowasjee's mainmast in Lat.  $17^{\circ} 58'$ ; Long.  $86^{\circ} 5'$  East.

To this very valuable log Captain Andrew adds, in his remarks in a letter written from Aden, "I do not think we were within the revolving disk till we got the wind at N. N. E. Consequently I do not think by any manœuvre I could have got better weather than I had. I made a sort of diagram at the time and made the track of the Cyclone about N. W. b. W.  $\frac{1}{2}$  W."

#### *At Calcutta.*

There was nothing remarkable in the weather at Calcutta till the 13th October, on which day my notes begin as follows.

13th October—4 A. M. Bar. 29.810; Simpiesometer 29.760; at 6 A. M. Bar. 29.810; Simpiesometer 29.76; the sky a dull white haze above, below heavy nimbi and cumulo nimbi with broken light scud flying beneath all. Wind E. b. N. and N. E. in the squalls; squally and then almost calm. Lower scud flying from about E. N. E. the heavy clouds from E. b. S. At  $\frac{1}{2}$  past noon calms and light squalls; Bar. 29.84; Simpiesometer 29.76; Ther. 82 $\frac{1}{4}$ . Dark gloomy weather with heavy dark nimbi, cumuli and strata, moving at a moderate

rate\* from the N. E. ; drizzling and light rain. The heaviest masses of clouds to the S. E. At 4 P. M. Bar. 29.79 ; Simp. 29.70 ; Ther.  $81\frac{1}{2}$ ° ; fresh breezes at times from N. E. but not constant. At 7h. P. M. Bar. 29.79 ; Simp. 29.75 ; Ther. 82°. Squalls, rain and some little moaning wind from the N. E. Sky a dull white haze with strata, &c. as at noon and 4 P. M., but fewer moving clouds and those slower.

14th Oct.—9 A. M. Bar. 29.80 ; Simp. 29.73 ; Ther. 81°. Alternate squalls with heavy rain and breaks in the clouds ; calm with appearances of clearing up. Wind N. E. scud from about East moving fast at times. P. M. alternate squalls and calms with distant thunder, wind hauling to the Eastward and the scud from S. E. and E. S. E.

15th Oct.—During the night rain, blowing fresh in squalls S. Easterly. A. M. squalls with fresh gale at times from S. East ; heavy banks to S. E. and South ; scud from S. S. W. At  $7\frac{1}{2}$  A. M. Bar. 29.76 ; Simp. 29.70 ; Ther. 82°. 10 A. M. Bar. 29.83 ; Simp. 29.72 ; Ther.  $82\frac{1}{4}$ °. Moderate breezes, and then almost calm, with heavy puffs at times ; wind S. S. W. to South, dark gloomy weather. At 0.30 P. M. Bar. 29.80 ; Simp. 79.72. The  $82\frac{1}{4}$ ° light breezes.

After this time the weather gradually becoming fine.

\* Taking these to have been influenced by the vortex this is what should occur from their great distance (205 miles at noon) from the centre.

[To be continued.]

PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL

FOR AUGUST, 1849.

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At a meeting of the Asiatic Society held on Wednesday, the 1st of August, 1849.

Dr. J. McCLELLAND in the chair.

The proceedings of the former meeting were read and confirmed, and the accounts and vouchers of the preceding month were laid upon the table as usual.

The following gentlemen who had been proposed and seconded at the last meeting, were balloted for and duly elected.

*Arthur Grote, Esq. B. C. S.*

*Doctor Martin.*

Candidate for election at the September meeting, viz.: Raja Pratapchandra Singha.

*Babu Rajendra Dutto*, proposed by F. E. Hall, Esq. seconded by J. W. Laidlay.

Read letters—

From Captain J. D. Cunningham, Engineers, forwarding a paper "On the Embankments of rivers, and on the Nature of overflowing rivers in diluvial plains."

From Dr. Harrwitz, Berlin, proposing an exchange of works, published by F. Duemmler in Berlin with those of the Society, and forwards a list of Sanskrit works published by F. Duemmler. Referred to the Oriental Section.

From John Barlow, Esq. Secy. Royal Institution of Great Britain, acknowledging the receipt of the Society's Journal.

From F. E. Hall, Esq. to publish the *Bhakta Mala* in the *Bibliotheca Indica*. Referred to the Oriental Section.

From the same requesting to be allowed to take with him to Mofussil, 10 or 12 Persian works, for reference, and some other Hindu Books.

From Major Madden, forwarding Supplementary Notes to the Turæe and outer mountains of Kumaon.

From the Secretary to the Bombay Geographical Society, forwarding a complete set of the translation of the Society, and requesting an exchange of publication to be established between them.

Proposed by Mr. Jackson, and seconded by Capt. Forbes, that all proposals of this kind from individuals or Society, for the exchange of books be in the first place laid before the Council.

From Dr. Roer, proposing Mr. Ariel, Secretary to the Government of Pondichery, to be elected a corresponding member of the Asiatic Society, seconded by Mr. H. Alexander.

From the same, proposing the printing of certain Upanishads in the Bibliotheca Indica.

The Zoological and Geological Curators having read their respective reports.

The President stated that he had the pleasure of laying before the meeting, the Catalogue of the Birds in the Society's Museum recently prepared by Mr. Blyth.

After some remarks upon that work, Mr. Welby Jackson suggested that a copy be circulated to the Council of the Society, that its price and the number of copies to be placed at the disposal of the author to be determined upon.

The ordinary business of the evening being concluded, the President called the attention of the meeting to the financial position of the Society, read the subjoined report upon that subject from the Council.

Some discussion having arisen upon the various items of retrenchment suggested by the Council, it was proposed by Babu Ramgopaul Ghose, seconded by Mr. Mitchell, and carried—

“That the Report of the Council be received with thanks, but that its consideration be postponed till the next monthly meeting, and that in the meantime, it should be circulated to resident members along with the accounts now laid on the tables.”

The meeting then adjourned.

J. McCLELLAND,

J. W. LAIDLAY.

FINANCIAL REPORT.

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The subjoined Report of the Council of the Asiatic Society is printed for circulation among the Members, in pursuance of a resolution passed at the Meeting of the Society, 1st August, 1849.

J. W. LAIDLAY,  
*V. P. and Sec.*

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The Council of the Asiatic Society having anxiously considered a statement of the financial position of the Society submitted by the Secretaries, deem it their duty to recommend considerable reductions in the Society's present expenditure, the adoption of which the Council believe cannot be postponed without exposing the Society to the risk of falling into a state of serious, if not ruinous, embarrassment.

On a careful examination of the accounts, it appears that the present liabilities of the Society exceed the amount of its available assets by Rs. 2,557 6 7; that whilst on the one hand sums, which though nominally due to the Society are supposed to be irrecoverable, have been carefully excluded from the list of available assets, and the list of liabilities includes some sums not likely to be presently claimed, and others which represent demands that in their nature are extraordinary and unlikely to recur; yet on the other hand the liabilities which now exist are certain in amount, whilst the outstanding assets when actually realised may fall short even of the amount now assumed to be capable of realization. It further appears, and this is a fact which the Council desire to impress particularly upon the Society, that if the monthly income and expenditure of the Society remain unaltered, its embarrassment must increase, because the present ordinary expenditure exceeds the present income by the sum of Rs. 179 6 0 per mensem. This is of course a state of things which none can wish to continue; but the Council beg further to remark that in their judgment it is not merely by limiting the ordinary expenditure of the Society to the amount of its income, or even by the discharge of its present debts that the Society's finances can be placed upon a satisfactory footing. Provision should be made for the purchase of books, the occasional repairs or improvement of the premises, the preservation and extension of our collections, and the other extraordinary demands



to which this, like every other Society of similar constitution, has hitherto been, and is likely to continue subject.

The Council regret that some of the reductions which they recommend will press heavily upon individual officers of the Society; a consequence which the Council would willingly have avoided, had they seen any other mode of extricating the Society from its difficulties.

In proposing such reductions they desire to be understood as expressing, not any opinion that the officers who will be affected are now too highly remunerated with reference to their attainments, but a deliberate conviction that the affairs of the Society must henceforth be conducted upon a more economical scale, and that they may be efficiently conducted notwithstanding the reductions proposed.

The following are the principal reductions recommended by the Council.

*1st.* They recommend that the European Accountant at present employed by the Secretaries be hereafter dispensed with. This will effect a saving of Rs. 60 per mensem. The Council are by no means insensible to the importance of providing for the due keeping and audit of the Society's accounts. But the native writer attached to the Secretary's office ought to be, and the Council believe is, fully competent to keep the accounts; and the Council believe that a far more effectual and satisfactory system of audit than any which has yet been provided, would be found in the appointment by the Society of three or more of its members to act as a Finance Committee. The Council think that the duties of such a Committee need not be restricted to the mere auditing of the Secretaries' accounts, but that in every case in which the Society is called upon to make a vote of money, it might usefully refer to the Committee to report whether, having regard to the then state of the Society's finances, such an expenditure would be safe or prudent. This would in no degree affect the undoubted privilege of the Society at large to determine to what objects its money should be applied, whilst it would afford a safeguard against hasty and improvident votes by which the resources of the Society are liable to be anticipated. A further, though slight reduction is proposed in the Secretaries' office by the removal, of one of the peons at present employed there.

*2nd.* The Zoological department as at present constituted, is a

heavy burthen upon the Society's finances. Over and above the Curator's salary of Rs. 250, and the allowance for collecting and preserving specimens received from Government, the Society expends in this department out of its own resources about Rs. 142 8. The establishment, independently of the Curator, consists of four Taxidermists or assistants, and two Carpenters, besides Durwans and Feshes, who ought properly to be included in the general establishment of the Society. The Society has further, pursuant to a resolution of the 21st day of Oct. 1845, to pay the sum of Rs. 40 per mensem as a house allowance to the Curator. The Contingent bill of the department more than exhausts the Government monthly allowance of Rs. 50.

The Council consider it essential for the well-being of the Society under existing circumstances to reduce the expenditure under this head to an amount exceeding as little as possible that of the Government allowances. They propose therefore that the establishment be reduced to a Curator, and two Taxidermists at Rs. 30 each ; that one of those Taxidermists be paid out of the Government allowance of Rs. 50. per mensem ; that the contingencies, including carpenter's work (the present carpenters being no longer kept on the fixed establishment) be limited as far as possible to the balance of that sum. They further propose that the house allowance to the Curator, a charge which the funds of the Society are no longer adequate to bear, be discontinued, but that his reduction do not take effect until the 1st of October next.

*3rd.* With respect to the Library, the Council recommend that the fixed establishment consist merely of one Librarian at a monthly salary of Co.'s Rs. 50, who is to have the charge of all the books whether European or Oriental. Of this sum the Council consider that Co.'s Rs. 25 should be paid by the Oriental Fund, which has hitherto borne the charge of Rs. 30 per mensem, for the Moulvie who took care of the Arabic and Persian works. They recommend that the services of the Moulvie in this respect be discontinued, and that for the future no Moulvie or Pundit form part of the fixed establishment of the Society, but the cost of employing such persons, if their services are required for the purposes of collation or copying MSS., or of correcting the press, be treated as contingent, and defrayed accordingly out of the Oriental Fund. It is proposed that this reduction of

the present Librarian's salary should not take effect until the 1st of October. The Duffries and other menial servants to be employed in the Library, form part of the general establishment of servants now proposed, and some reduction in this respect will also be effected.

The general establishment of servants now proposed will be found in the paper marked (No. 6). Several useless servants will be dispensed with, and the whole expence of the establishment now proposed will be Rs. 781 8 0, whilst the expences of the present establishment are Rs. 1089 8 0, and thus if the reductions now proposed be adopted, the saving to the Society will be Rs. 338 0 0\* per mensem.

For the elucidation, and in confirmation of the foregoing statement, the Council lay upon the table of the Society, the following accounts and papers, viz :

No. 1, Statement of the Debts and Dependencies of the Asiatic Society.

No. 2, Statement of the average monthly Income and Expenditure of the Asiatic Society.

No. 3, Statement of the monthly Expenditure of the Asiatic Society, as proposed by the Council.

No. 4, Changes among the Members from death, withdrawal, &c.

No. 5, List of Members of the Asiatic Society of Bengal.

No. 6, Revised Scheme of an Establishment of the Asiatic Society, as proposed by the Council.

One of the heaviest items in the Society's expenditure is the outlay for the publication of the Journal. The council would recommend no reduction on this head, which might interfere with the dissemination of this work. On full consideration of the subject however, they conceive that the number of copies printed may safely be reduced to 400, and without laying down any definite or inviolable rule for the conduct of the work, they recommend that for the future, the Secretaries limit as far as possible, the outlay on the work to Rs. 250 per month.

If this can be effected, the saving to the Society, by means of these General reductions, will be increased to Rs. 528.

* Saving on account Establishment, Rs. ....	308
Ditto ditto Contingencies in the Zoological Department .....	30

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Co.'s Rs. 338

*Statement of the Old and Revised Establishment of the Asiatic Society, shewing in detail the Items of Saving, per month, to the Society, and to Government Allowances.*

OLD ESTABLISHMENT.		REVISED ESTABLISHMENT.		SAVING.		REMARKS.
Designation.	Salaries per month.	Designation.	Salaries per month.	Items of.	Saving per month.	
	From Socie- ty's fund.		From Govt. allowance.		From Socie- ty's fund.	From Govt. allowance.
Zoological Curator-Salary,	..	Zoological Curator-Sala- ry, .....	250	..	..	..
Ditto House rent, .....	40	..	..	Allowance of House rent to Zoological curator, ..	40	..
1 Assistant to Ditto, .....	20	1 Taxidermist, .....	..	Assistant to ditto, .....	20	..
3 Taxidermists, .....	75	1 Ditto, .....	30	2 Taxidermists, .....	45	..
2 Carpenters, .....	13	..	..	..	..	..
Mus. Eco: GEOLY. CU- RATOR-SALARY,	..	Mus. Eco. GEOLY. CU- RATOR-SALARY,	250	2 Carpenters, .....	13	..
1 Writer, .....	..	1 Writer, .....	16	..	..	..
1 Carpenter, .....	..	1 Carpenter, .....	8	..	..	..
1 Peon, .....	..	1 Peon, .....	5	..	..	..
1 Pankha boy, .....	..	..	2	1 Pankha boy, .....	..	..

Paid by Government.

Rs. 30 to be paid out of  
the 50 Rs. allowed by  
Govt. for prepf. speci-  
mens of Nat. Hist.

Paid by Government.  
This Establishment is sanc-  
tioned by Govt. who al-  
low 64 Rs. for it and  
contingencies.

Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of Aug., 1849.

Date.	Observations made at sunrise.					Barometric Pressure observed at 9h. 50m.					Observations made at sunset noon.							
	Bar. red. to 32° F.	Temperature.			Wind.	Aspect of Sky.	Bar. red. to 32° F.	Temperature.			Wind.	Aspect of Sky.	Bar. red. to 32° F.	Temperature.			Wind.	Aspect of Sky.
		Of Mer.	Of Air.	W. Bulb.				Of Mer.	Of Air.	W. Bulb.				Of Mer.	Of Air.	W. Bulb.		
1	29.415	80.9	81.5	79.9	N. E.	Cloudy	29.423	86.5	85.9	81.8	E. N. E.	Cumulo strati	29.380	88.7	84.8	81.7	N. E.	Cumulo strati
2	368	79.3	80.0	78.3	E. sharp.	Ditto	.442	85.6	82.3	79.8	S. S. E.	Cloudy	.434	88.0	87.4	81.0	S. S. E.	Nimbi
3	.512	78.1	79.3	77.6	S. S. W.	Scattered clouds.	.546	85.2	85.0	79.4	S. W.	Ditto	.518	87.7	87.0	79.6	S. S. W.	Cumulo strati
4	.509	78.6	79.2	76.7	S. W.	Cloudy	.538	82.0	82.2	78.3	S. W.	Ditto	.517	85.2	84.7	79.0	S. S. W.	Cloudy
5	.505	80.4	81.8	79.9	S. W.	Ditto	.513	86.3	86.2	82.2	N. N. W.	Cumulo strati	.490	90.6	82.0	82.2	N. E.	Cumulo strati
6	.497	79.9	81.1	78.8	S. E.	Scattered clouds.	.497	87.3	86.0	80.8	E.	Ditto	.483	90.9	90.3	82.4	E.	Ditto
7	.475	80.0	80.8	78.9	S. E.	Cumuli	.524	88.2	87.0	81.0	S. S. E.	Nimbi	.511	89.5	88.8	81.8	S. S. E.	Nimbi
8	.509	78.0	78.9	76.3	S. W.	Cirro cumuli	.639	85.6	85.6	79.0	S. W.	Ditto	.622	83.8	84.2	78.9	S. W.	Ditto
9	.609	77.3	77.8	76.3	S. W.	Zenith clear	.613	86.7	83.5	79.7	S. W.	Ditto	.623	87.3	86.6	81.0	S. E.	Cumulo strati
10	.656	79.5	80.3	78.9	S.	Cirro cumuli	.708	86.3	85.0	81.1	S. S. W.	Drizzly	.712	81.7	82.4	80.3	S. S. E.	Cloudy
11	..	..	..	..	....	....	..	..	..	..	....	....	.703	82.0	82.1	80.2	S. S. W.	Drizzly
12	..	..	..	..	....	....	..	..	..	..	....	....	..	..	..	..	..	..
13	.556	77.9	78.3	76.5	S. W.	Cirro cumuli	.614	84.3	84.0	80.0	S. W.	Nimbi	.568	89.6	87.8	80.7	W. S. W.	Cumulo strati
14	.532	81.5	82.0	80.4	S. W.	Cumulo strati	.560	87.1	86.7	82.1	N.	Cumulo strati	.539	91.4	90.2	82.2	N. S. E.	Ditto
15	.545	80.2	81.2	79.7	E. N. E.	Cloudy	.511	86.2	84.7	80.6	E.	Ditto	.506	88.7	87.5	81.3	N. E.	Ditto
16	.679	77.8	78.3	77.0	S. S. E.	Ditto	.765	78.4	78.8	77.8	S.	Cloudy	.753	80.1	79.8	77.7	S. S. E.	Cloudy
17	.816	79.7	80.7	79.6	S. E.	Ditto	.861	82.0	87.3	81.9	S.	Cumulo strati	.830	90.3	89.4	82.5	S. S. W.	Cumulo strati
18	.795	80.0	80.8	79.2	S.	Ditto	.834	85.0	85.2	81.7	S. W.	Cloudy	.801	86.2	85.8	82.2	S. W.	Cloudy
19	.764	77.3	78.0	76.9	S. W.	Drizzly	.809	81.3	81.6	80.0	S. S. W.	Drizzly	.809	81.0	81.2	79.1	S. W.	Drizzly
20	..	..	..	..	....	....	..	..	..	..	....	....	..	..	..	..	..	..
21	.740	79.3	79.8	78.0	S. W.	Clear	.784	88.5	87.0	81.0	S. W.	Cumulo strati	.744	90.0	89.9	82.0	W. N. W.	Cumulo strati
22	.706	80.8	81.6	80.0	S. S. W.	Ditto	.753	88.4	87.2	82.2	S. W.	Ditto	.723	89.7	88.1	82.3	S. S. W.	Ditto
23	.700	81.8	82.4	81.2	S.	Cirro cumuli	.754	88.0	86.9	81.8	S. W.	Ditto	.725	90.0	89.7	82.7	S. W.	Ditto
24	.690	82.2	82.9	81.9	S. W.	Cloudy	.725	89.0	88.7	83.2	S. S. W.	Ditto	.700	93.0	91.0	83.0	S.	Ditto
25	.670	81.7	82.3	81.3	S.	Cirro strati	.708	89.9	87.9	82.8	S. S. W.	Nimbi	.668	91.5	90.5	82.8	E. S. E.	Ditto
26	.608	81.1	81.8	80.3	S.	Ditto	.656	88.1	87.8	82.4	S. W.	Cumulo strati	.587	91.8	90.4	82.2	S. W.	Ditto
27	.570	81.2	81.9	80.2	S. S. W.	Zenith clear	.610	89.6	88.1	82.3	S. W.	Ditto	.563	91.9	90.0	82.7	S. W.	Ditto
28	.561	81.6	82.0	80.7	S.	Cloudy	.618	89.7	88.1	82.9	S.	Ditto	.585	91.5	90.3	83.0	S. W.	Ditto
29	.512	80.8	81.4	79.8	E. S. E.	Cumuli	.659	90.0	89.0	82.0	S. W.	Ditto	.619	90.7	88.0	81.6	S. S. W.	Ditto
30	.596	80.2	80.2	78.7	S. E.	Cloudy	.817	88.0	87.0	81.3	S. E.	Ditto	.572	92.3	90.9	82.2	S. S. E.	Ditto
31	.541	81.2	81.8	80.3	E. S. E.	Ditto	.550	89.9	87.3	81.4	E.	Ditto	.532	90.9	88.9	82.3	S. E.	Cumuli
Mean	29.600	80.0	80.6	79.0	..	....	29.630	86.8	85.8	81.1	....	....	29.614	88.5	87.6	81.4	....	....









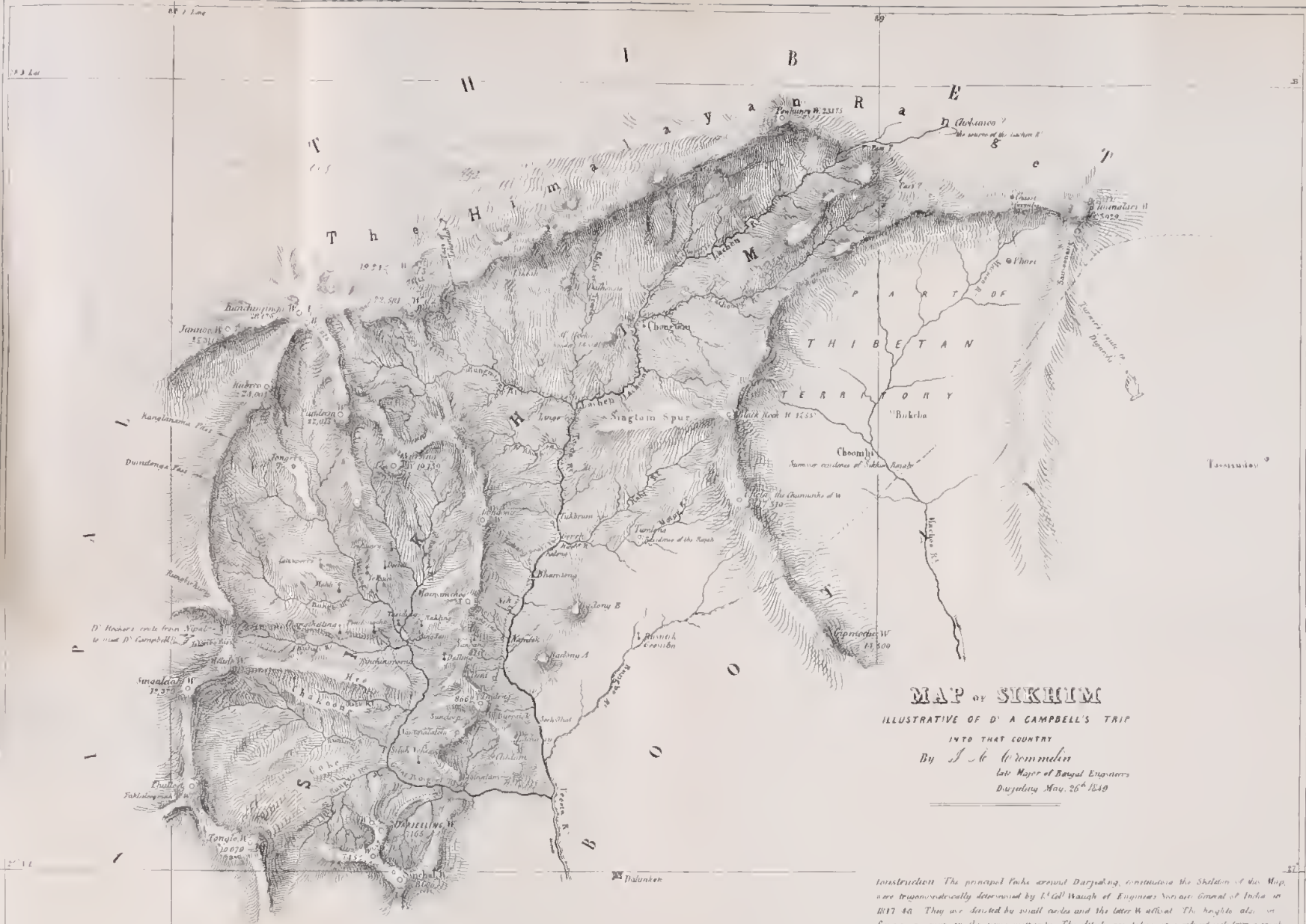
100	Librarian's Salary, .....	30	1 Librarian, .....	25	Part of Librarian's pay, ..	75	Rs. 25 to be paid to the Librarian out of the 30 Rs. allowed to Moulvie from the Oriental Fund.
..	Moulvie, Ditto, .....	30	To Ditto, .....	..	Saving from Moulvie and Pundit's pay, .....	..	
..	Pundit, Ditto, .....	..	..	..	..	..	
40	House Sergeant, Ditto, ..	..	1 House Sergeant, .....	40	..	..	Paid from the Oriental Fund.
8	1 Duftry, .....	..	1 Duftry, .....	8	..	..	
..	1 Ditto, .....	6	1 Ditto, .....	..	6	..	
SECRETARY'S OFFICE.							
60	Accountant, .....	..	Writer, .....	20	Accountant, .....	60	
20	Writer, .....	..	Sircar, .....	6	Duftry, .....	3	
6	Sircar, .....	..	3 Peons, .....	16	1 Peon, .....	6	
3	Duftry, .....	..	1 Durwan, .....	6	2 Durwans, .....	12	
22	4 Peons, .....	..	1 Chowkedar, .....	6	1 Chowkedar, .....	6	
18	3 Durwans, .....	..	3 Bearers, .....	18	3 Ferashes, .....	17	
12	2 Chowkedars, .....	..	1 Bearer, .....	..	..	..	Paid from the Oriental Fund.
35	6 Ferashes, .....	6	1 Sweeper, .....	5	..	..	
..	1 Ditto, .....	..	1 Bhisty, .....	3	1 Malee, .....	4	
5	Sweeper, .....	..	1 Sicklegar, .....	2	..	..	
3	Bhistry, .....	..	..	..	..	..	
4	Malee, .....	..	..	..	..	..	
2	Sicklegar, .....	..	..	..	..	..	
486 8	Co's Rs., ..	603 0	..	185 8	Co's Rs., ..	301	Including the saving on acct. contingencies in the Zoological Dept.
603 0	..	..	..	596 0	301 0	..	
1,089 8	Original Est. Rs.,	..	..	..	37 0	..	
781 8	Revised Do,	..	..	..	Rs, 338 0	..	
Rs. 338 0	Saving in all } including contingencies,	..	..	..	..	..	

J. W. LAIDLAY, Secretary.









### MAP OF SIKKIM

ILLUSTRATIVE OF D. A. CAMPBELL'S TRIP

INTO THAT COUNTRY

By J. G. WOODHEAD

late Major of Bengal Engineers

Darjeeling May 26<sup>th</sup> 1849

SCALE 8 MILES TO ONE INCH

C D Site of the Conventual Depot for H M Troops, elevation 7800 ft

1 B The site of the Monastery are indicated by crosses thus b

*Construction* The principal peaks around Darjeeling, constitute the skeleton of the Map, were topographically determined by Col Waugh of Engineers Survey General of India in 1817-18. They are denoted by small circles and the letter W affixed. The heights also, in figures are given on the same numbers. The details are taken on a reduced scale from a rough Map by D. J. D. Hooper of his own travels in Nepal and Sikkim, and from the observations of D. Campbell. The country to the East of the Teesta and the whole of S.E. Sikkim beyond Teesta, is as yet unexplored and unknown, but the researches of D. Hooper who is now at his post at there and some of whose more recent observations are preterated on the Map will doubtless serve to throw much light upon the topography of this wild and interesting country.





